INSTALLATION RESTORATION PROGRAM

PRELIMINARY ASSESSMENT / SITE INSPECTION WORK PLAN

143rd COMBAT COMMUNICATIONS SQUADRON
SEATTLE AIR NATIONAL GUARD STATION
WASHINGTON AIR NATIONAL GUARD
SEATTLE, WASHINGTON

APRIL 1994

AIR NATIONAL GUARD READINESS CENTER
ANDREWS AFB, MARYLAND 20331

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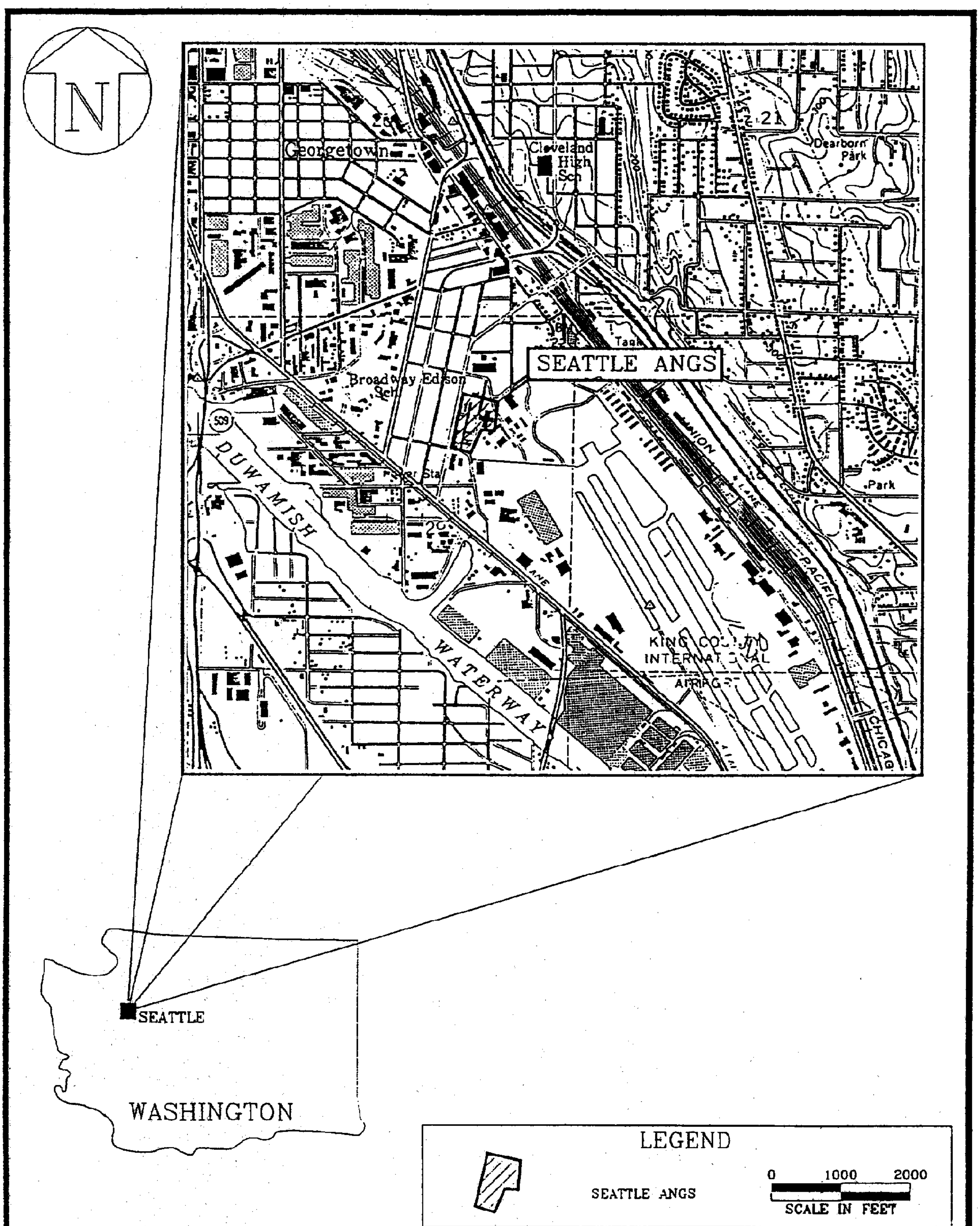
Preliminary Assesment/site Inspection work Plan Apr. 94



SOURCE: USGS & NATIONAL OCEAN SERVICE. 7.5' X 15' TOPOGRAPHIC – BATHYMETRIC QUADRANGLE MAP SOUTH SEATTLE, WASHINGTON. 1983.

INSIDE FRONT COVER SEA-IFC	STATION LOCATION MAP 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

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Prepared For

AIR NATIONAL GUARD READINESS CENTER
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List of Acronyms

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LIST OF ACRONYMS

AGE	Aerospace Ground Equipment
ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ANGRC/CEVR	Air National Guard Readiness Center/Installation Restoration Program Branch
ANGS	Air National Guard Station
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
ATHA	Ambient temperature headspace analysis
AWQC	Ambient Water Quality Criteria
BH	Borehole
BLS	Below land surface
BTEX	Benzene, toluene, ethylbenzene, xylenes
CAA	Clean Air Act
CCSQ	Combat Communication Squadron
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQP	Corporate Environmental Quality Assurance/Quality Control Plan
CES	Civil Engineering Squadron
CFR	Code of Federal Regulations
CGI	Combustible gas indicator
CPR	Cardiopulmonary Resuscitation
CWA	Clean Water Act
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DOE	Department of Ecology
DOT	Department of Transportation
DPM	Defense Priority Model
DRMO	Defense Reutilization and Marketing Office
ECAMP	Environmental Compliance Assessment and Management Program
EO	Executive Order
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
FTA	Fire-training area
GC	Gas chromatograph
gpm	Gallons per minute
GPR	Ground-penetrating radar
HDPE	High-density polyethylene
HM/HW	Hazardous materials/hazardous wastes
HRS	Hazard Ranking System
HSA	Hollow-stem auger

LIST OF ACRONYMS (Continued)

HSP	Health and Safety Plan
IRP	Installation Restoration Program
LEL	Lower explosive limit
MAP	Management Action Plan
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goals
MEK	Methyl ethyl ketone
MHz	Megahertz
mL	Milliliter
MOGAS	Motor Vehicle Gasoline
MSL	Mean sea level
NAAQS	National Primary and Secondary Ambient Air Quality Standards
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
OSHA	Occupational Safety and Health Administration
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Inspection
PCBs	Polychlorinated biphenyls
PEST	Pesticide
PID	Photoionization detector
PVC	Polyvinyl chloride
QA/QC	Quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RCW	Revised Code of Washington
RD	Remedial Design
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SI	Site Inspection
SM	Site manager
SOW	Scope of work
SPT	Standard penetration test
SSO	Site safety officer
SVOC	Semivolatile organic compound
TCLP	Toxic Characteristic Leaching Procedure
TSCA	Toxic Substance Control Act
TSD	Treatment, storage or disposal
μg/L	Micrograms per liter
USEPA	United States Environmental Protection Agency

LIST OF ACRONYMS (Concluded)

UST	Underground storage tank
UTA	Unit Training Assembly
VOA	Volatile organic analysis
VOC	Volatile organic compound
WAC	Washington Administrative Code

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Section 1

INSTALLATION RESTORATION PROGRAM
PRELIMINARY ASSESSMENT/SITE INVESTIGATION WORK PLAN

SECTION 1.0 INTRODUCTION

This Preliminary Assessment/Site Inspection (PA/SI) work plan outlines activities for completing the PA initiated by personnel from the Air National Guard Readiness Center/Installation Restoration Program (IRP) Branch (ANGRC/CEVR), Andrews AFB, Maryland, and conducting an SI at one identified Area of Concern (AOC) (hereinafter designated as the Burial Site AOC), located at the 143rd Combat Communications Squadron (CCSQ), Seattle Air National Guard Station (ANGS) (also referred to as the "Station"), Seattle, Washington (see inside front cover figure). The Work Plan also discusses the results of the PA. The PA/SI is conducted under the authority of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

The Defense Environmental Restoration Program (DERP) was established in 1984 to promote and coordinate efforts for the evaluation and cleanup of contamination at Department of Defense (DoD) installations. On 23 January 1987, Presidential Executive Order (EO) 12580 was issued which assigned the responsibility to the Secretary of Defense for carrying out DERP within the overall framework of SARA and CERCLA. The IRP was established under DERP to identify, investigate, and clean up contamination at installations. The IRP is focused on cleanup of contamination associated with past DoD activities to ensure that threats to public health are eliminated and to restore natural resources for future use. The Air National Guard Readiness Center (ANGRC) manages the IRP and related activities. The ANGRC/CEVR authorized Operational Technologies Corporation (OpTech) to prepare a PA/SI work plan and conduct the SI at Seattle ANGS.

1.1 PROJECT OBJECTIVES AND SCOPE

1.1.1 PA/SI Project Objectives

The PA/SI consisted of personnel interviews and a records search designed to identify and evaluate past disposal and/or spill sites that might pose a potential and/or actual hazard to public health, public welfare, or the environment. The SI will include field activities designed to confirm the presence or absence of contamination at the AOC identified in the PA and will provide data needed to reach a decision point for the site. The general approach of the PA/SI is to sequence activities so that data are acquired and used as the field inspection progresses.

The overall objective of the PA/SI is to identify and evaluate suspected problems associated with past waste handling procedures, disposal sites, and spill sites and to attempt to determine if the AOC is environmentally significant enough to warrant classification as a formal site under the IRP. In addition, the completed PA/SI report will provide specific information required to complete the Hazard Ranking System (HRS) "Data Requirements for Federal Facility Docket Sites" (see Appendix C) and to complete the Defense Priority Model (DPM) scoring.

The specific objectives of the PA/SI are to:

- Identify all operations at the Station that may have used hazardous materials or may have generated hazardous waste.

- Obtain available geological, hydrological, meteorological, and environmental data and define hydrogeologic conditions that affect contaminant migration, containment, or cleanup.

- Provide data to assist in determining the presence, type, or absence of contamination at the AOC.

- Support site-specific decisions, such as no further action, or identification of the AOC as requiring further investigation in the form of a Remedial Investigation/Feasibility Study (RI/FS).

1.1.2 Scope of Work

The scope of work (SOW) for the PA/SI is to complete the PA and to perform screening-type field work to determine if the identified AOC is significant enough to warrant classification as an IRP site. Completing the assessment and conducting the investigation of the identified AOC at Seattle ANGS will include, but not be necessarily limited to, the following actions: the identification of sites at or under primary control of the ANGS and the evaluation of potential receptors; the definition of the nature of the release at the identified AOC; the confirmation of the absence or presence of soil and groundwater contamination; the description of the geologic conditions of the installation study area, including the subsurface soil types and the presence or absence of hydrogeologic confining layers; and the definition of hydrogeologic conditions, such as groundwater flow direction. The results of the PA/SI study will provide the technical basis needed to reach a decision point for the AOC.

1.2 PREVIOUS ACTIVITIES

An Environmental Compliance Assessment and Management (ECAMP) Report for the 252nd Combat Communications Group, which included the 143rd CCSQ, was completed in November 1991 by EG&G Idaho, Inc. Additionally, two soil studies have been conducted at Seattle ANGS prior to new building construction. A Soils and Foundation Engineering Study was conducted by Hart Crowser and Associates, Inc. at the site of the proposed Building 202, the Aerospace Ground Equipment (AGE)/Motor Vehicle Building, in November 1974. A Subsurface Exploration and Geotechnical Engineering Study was conducted by Hart Crowser and Associates, Inc. prior to the construction of Building 201, the Communications and Administration Building, and Building 202 in January 1982. A PA of the 143rd CCSQ, Seattle ANGS was initiated by personnel from the ANGRC/CEVR in December 1991 and a draft PA report submitted in January 1993.

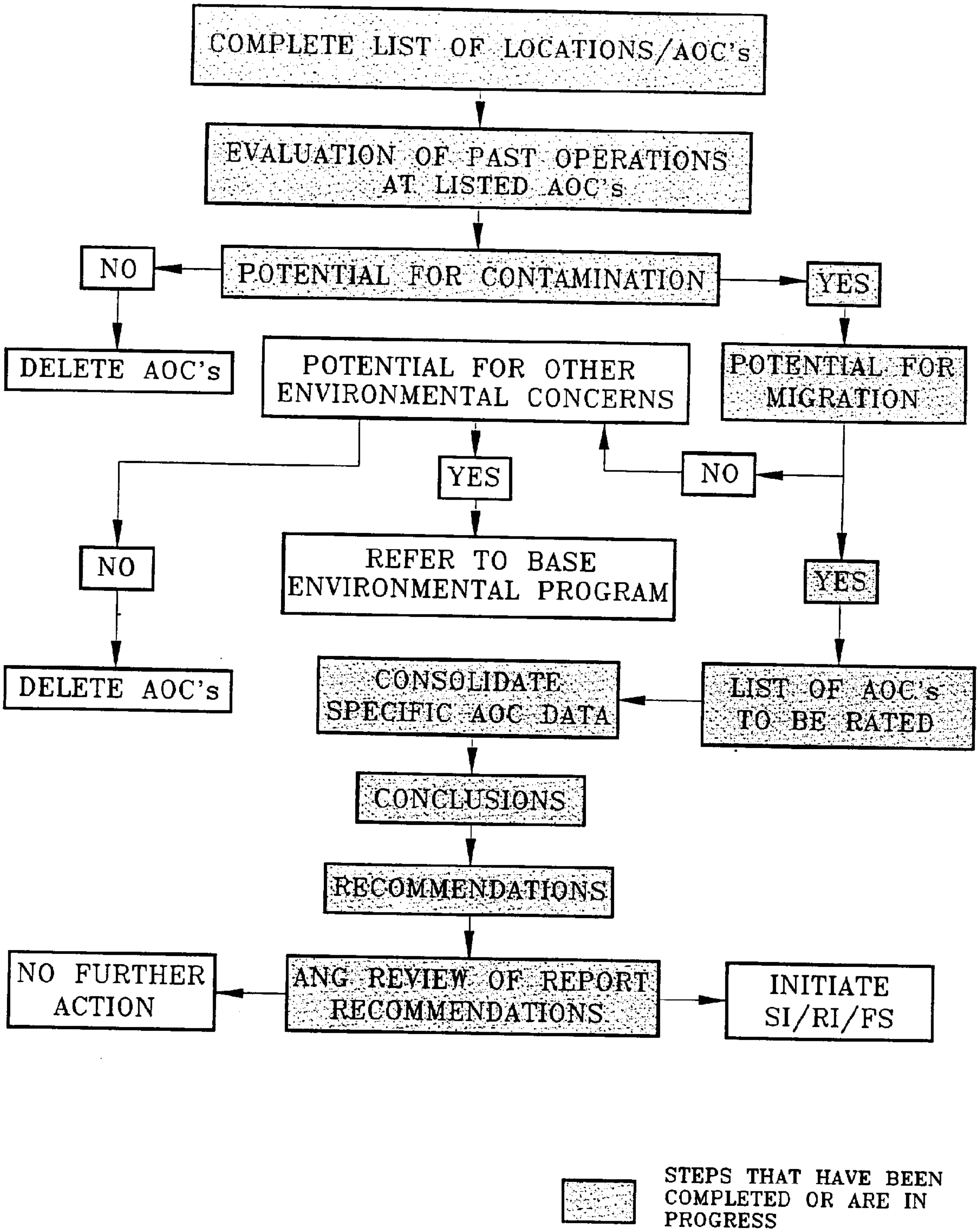
1.2.1 Preliminary Assessment (PA) Process

The purpose of the PA is to identify and evaluate the historical use, disposal, or release of hazardous materials and hazardous wastes (HM/HW) on an installation that may pose a potential or actual hazard to public health, public welfare, or the environment. From a variety of investigatory methodologies, AOCs on the installation are identified and documented. Along with the identification of the areas of potential contamination is the determination of any releases, the pathways of exposure, potential exposure targets, and a preliminary assessment of the threat to public health. The PA will also eliminate further consideration of those releases that pose no threat or potential threat to public health, public welfare, or the environment.

A flow chart of the PA methodology is presented in Figure 1.1. This methodology ensures a comprehensive collection and review of pertinent information and is used in the identification and assessment of potentially contaminated hazardous waste spill/disposal areas.

The PA begins with a visit to the Station to identify all shop operations or activities on the installation that may use hazardous materials or generate hazardous wastes. Next, an evaluation of both past and present HM/HW handling procedures is made to determine whether any environmental contamination has occurred. The evaluation of past HM/HW handling practices is facilitated by extensive interviews with past and present employees familiar with the various operating procedures at the Station. These interviews also define the areas at the Station where any HM/HW, either intentionally or inadvertently, may have been used, spilled, stored, disposed of, or otherwise released into the environment.

DECISION TREE



SOURCE: ANGRC/CEVR, 1993.

FIGURE 1.1 P\SEATTLE\PAMC-ADJ	PRELIMINARY ASSESSMENT METHODOLOGY CHART 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION APRIL

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Historic records contained in the Station files are collected and reviewed to supplement the information obtained from interviews. Using this information, a list of past waste spill/disposal areas on the Station is identified for further evaluation. A general survey tour of the identified spill/disposal areas, the Station, and the surrounding areas is conducted to determine the presence of visible contamination and to help assess the potential for contaminant migration.

Particular attention is given to locating nearby drainage ditches, surface water bodies, residences, and wells.

Detailed geological, hydrological, meteorological, developmental (land use and zoning), and environmental data for the area of study are also obtained from appropriate Federal, State, and local agencies. Following a detailed analysis of all the information obtained, areas are identified as suspect areas where HM/HW disposal may have occurred.

1.2.1.1 Facility History

Seattle ANGS was built during World War II by the War Department and was used by the Army Air Force as the "Aircraft Factory School" during the war. In 1948, the property was given to King County as surplus property and was subsequently leased to the Washington Air National Guard.

On 21 April 1948, the 143rd Aircraft Control and Warning Squadron was established. From May 1951 to February 1953, the 143rd was activated for recruitment purposes. During this period of time, the unit had two C-47 aircraft. In 1960, the name of the unit was formally changed to the 143rd Communications Squadron Tributary Teams. In 1969 and 1988, the name of the unit was again changed, becoming the 143rd Mobile Communications Squadron and the 143rd CCSQ, respectively. The current mission of the 143rd CCSQ is to provide mobile communication support and telephone/teletype support for airports and airfields.

In 1948, the Station consisted of 17 acres of land, including an aircraft parking ramp, leased from King County. At that time, the property contained 15 buildings (including a number of small shed structures), all of which were subsequently demolished. In 1951, a new property lease decreased the size of the Station from 17 acres to its present size of 7.5 acres (Figure 1.2). In 1980, the National Guard Bureau approved and Congress funded $2.3 million for replacement of all buildings. The buildings were completed in 1984, with the exception of the Mobility Warehouse, which was completed in 1988. Seattle ANGS now consists of 7.5 acres and four buildings (34,698 total square feet). The Seattle ANGS property is leased from King County

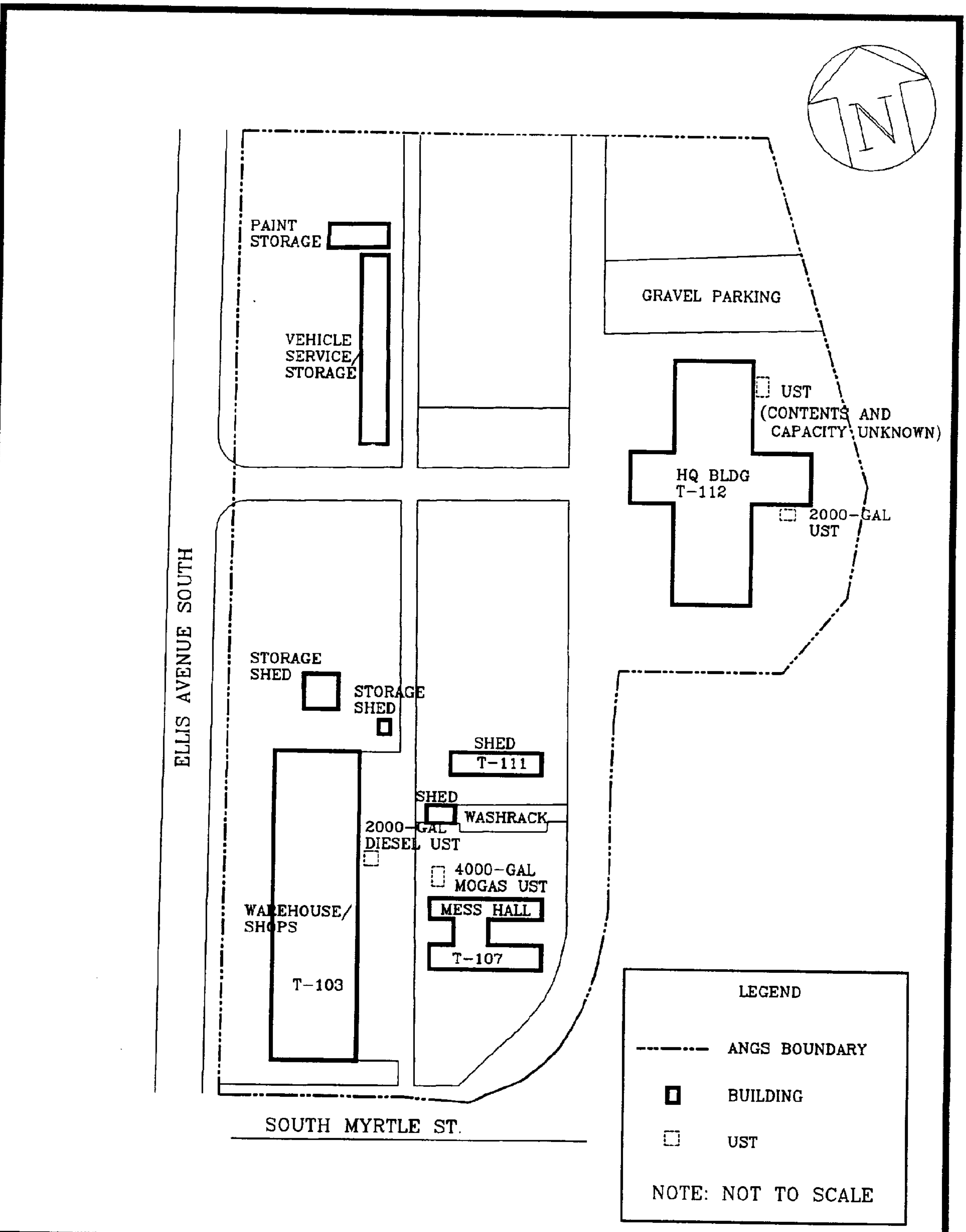

FIGURE 1.2

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SEATTLE ANGS PRIOR TO 1984 RECONSTRUCTION
143rd CCSQ, Seattle ANGS
Seattle, Washington

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by the U.S. Air Force, who in turn licenses the property to the Washington State Military Department for Air National Guard use.

1.2.2 PA Interview Process

Seattle ANGS activities which generate waste oils, cleaning solvents, paint wastes and thinners are conducted at the following locations: AGE/Motor Vehicle Maintenance, Power Production, and Communications/Administration.

During the PA, interviews were completed with four Station personnel covering the period from 1972 to 1992, with an average of 16 years' tenure with the Station (two people in Power Production, each with 20 years' tenure; and two people in Vehicle Maintenance, one with 11 years' tenure and the other with 14 years' tenure). These interviews confirmed past Station operations involving the use and disposal of materials and wastes that were subsequently categorized as hazardous. A table describing the volume and method of disposal of hazardous materials at the Station is provided in Section 1.2.4.

The interview process revealed a former waste burial site which is of concern due to historical practices of disposal of hazardous materials (Figure 1.3). In the early 1950s, various waste items were burned and/or buried in this area northeast of the old gravel parking lot. This area is now the asphalt vehicle parking lot east of current Buildings 202 and 203. This burial site was used for the burning and burial of various waste items, which included radio tubes, solvents, waste oil, kerosene, batteries, brake fluid, spray paints, paint thinners and removers, methyl ethyl ketone (MEK), xylene, and naphtha. The practice of waste burial in this area ended by 1968.

Other pertinent information identified during the PA interview process included the fact that all former underground storage tanks (USTs) previously located onsite were removed when the former buildings were demolished and the new facilities constructed in 1984. According to a Station plan dated 1982, there were four USTs previously located at the Station: a 4,000-gallon motor gasoline (MOGAS) UST, a 2,000-gallon diesel fuel UST, a 2,000-gallon UST (contents unknown), and a fourth UST (size and contents unknown). The location of these former USTs is shown in Figure 1.2.

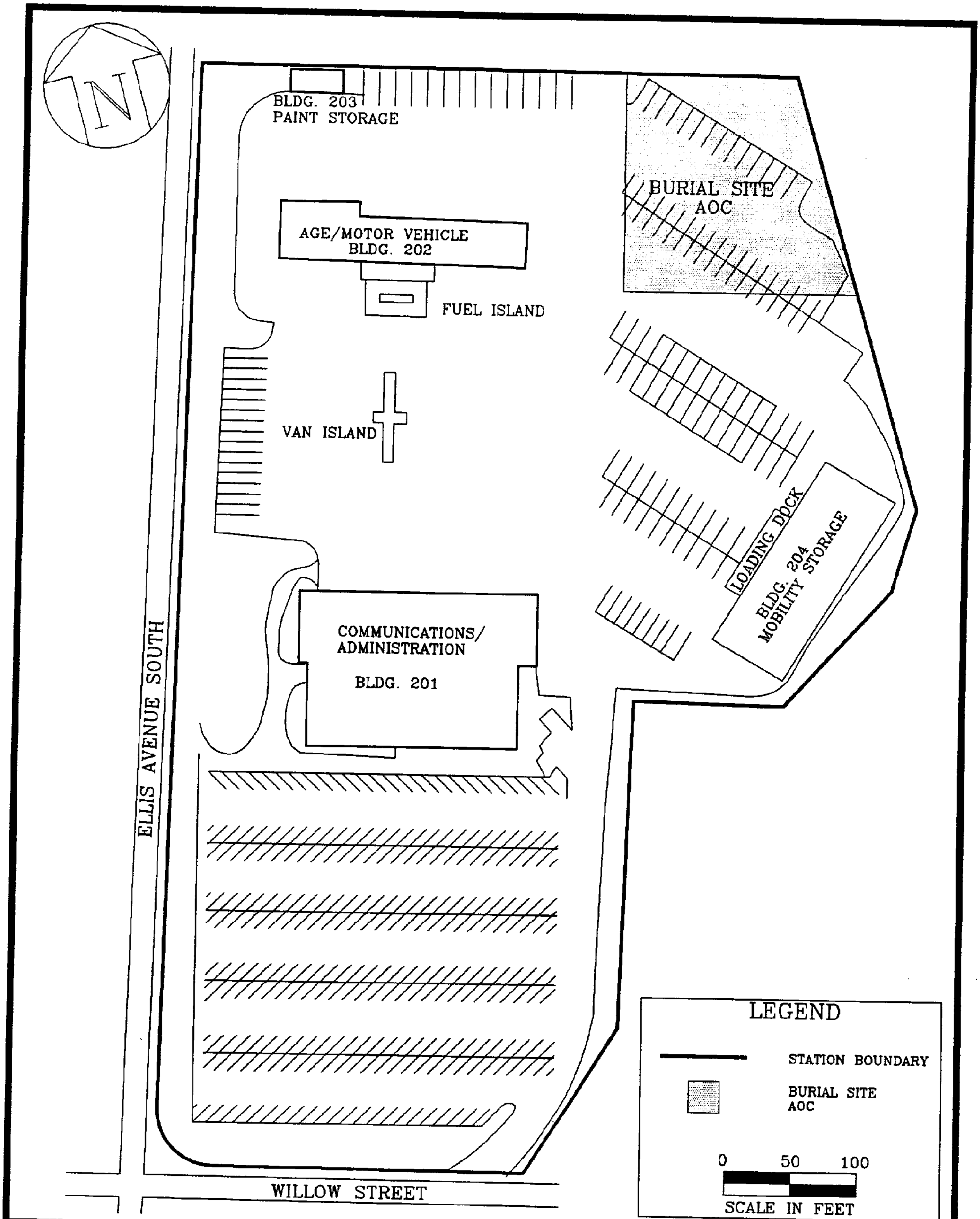

FIGURE 1.3

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LOCATION OF AOC MAP
143rd CCSQ, Seattle ANGS
Seattle, Washington

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1.2.3 PA Records Search Process

As part of the PA at Seattle ANGS, some Station records were obtained. These records provided more detailed or corroborating information about the Station in general. The following records were obtained:

- The Seattle ANGS Master Plan, including a Station map, water/sewer/storm drainage systems map, and electrical/gas systems map;
- Pertinent information and records on hazardous materials use and hazardous wastes generation and disposal at the Station;
- Available geologic, hydrologic, meteorologic, and environmental data from pertinent Federal, State, and local agencies; and
- Previous environmental investigations at the Station, including soil boring logs and investigation data and conclusions.
- Aerial photographs of the Station and surrounding area dated March 10, 1970 and August 6, 1981.
- "As-built" Station drawings dated April 30, 1982.

Except for an aerial photograph (of very poor resolution) of the general area taken in 1940, no site plans or photographs depicting the Station layout and its activities during the World War II period were available.

1.2.4 PA Station-Specific Information

Present and past ANG activities at Seattle ANGS have involved the use of potentially hazardous materials and the disposal of potentially hazardous wastes. In the past, small amounts of hazardous materials have been spilled or released into the environment at the Station. However, during recent years, hazardous wastes have typically been collected and disposed by a contractor or through the Defense Reutilization and Marketing Office (DRMO) at Fort Lewis, Washington. The historical disposition of these waste materials is shown in Table 1.1. Based on the information gathered, any operations not listed on Table 1.1 have been determined to produce negligible quantities of wastes requiring disposal.

Table 1.1
Inventory of Hazardous Materials Used at Seattle ANGS
143rd CCSQ, Seattle ANGS, Seattle, Washington

Shop	Possible Waste Materials	Quantities Disposed (Gals/year)	Methods of Treatment, Storage and Disposal In Chronological Order				
			1950s	1960s	1970s	1980s	Present
Power Production	Engine Oil	300	GRND	GRND	GRND	GRND/CIV	CIV
	MEK	5	GRND	GRND	GRND	GRND/DRMO	DRMO
	Gasoline	40	GRND	GRND	GRND	GRND/DRMO/CIV	DRMO
	Paint Stripper/Thinner	30	GRND	GRND	GRND	GRND/DRMO	DRMO
	Spray Paint Containers	30 ea.	LDFL	LDFL	LDFL	GRND/DRMO/CIV	DRMO/CIV
	Radio Tubes	UNK	DUMP	DUMP	LDFL	LDFL	LDFL
Vehicle Maintenance	Engine Oil	400	GRND	GRND	GRND	GRND/CIV	CIV
	Sulfuric Acid	5	GRND	GRND	GRND	GRND/DRMO	DRMO
	Ethylene Glycol	50	GRND	GRND	GRND	SAN	CIV
	Transmission Fluid	15	GRND	GRND	GRND	GRND	CIV
	Grease (Bearing)	5	GRND	GRND	GRND	LDFL	LDFL
	Paint Thinner	25	GRND	GRND	GRND	GRND/DRMO	DRMO
Air Conditioning/ Refrigeration	Refrigeration Oil	10	GRND	GRND	GRND	GRND	GRND/CIV
Battery	Battery Acid	60	LDFL	LDFL	LDFL	LDFL	LDFL
	Used Batteries	20 ea.	DRMO	DRMO	DRMO	DRMO	DRMO/CIV
Fuels Management	MOGAS	50	GRND	GRND	GRND	GRND/DRMO/CIV	DRMO/CIV
	Diesel Fuel	100	GRND	GRND	GRND	GRND/CIV	CIV

CIV – Disposed of through civilian contractor.
SAN – Disposed of in drains leading to sanitary sewer.
GRND – Disposed of on ground.
LDFL – Disposed of in landfill off-site.
MOGAS – Motor gasoline

DRMO – Directly to the Defense Reutilization and Marketing Office.
DUMP - Disposed of at dump site.
UNK - Unknown.
MEK - Methyl ethyl ketone.
Gals. - Gallons

The four USTs currently located at the Station (two 5,000-gallon USTs containing diesel fuel, one 5,000-gallon UST containing MOGAS, and one 550-gallon used oil UST) are approximately ten years old and are scheduled to be replaced by above-ground tanks in 1994. An oil/water separator is also located in the washrack area. All USTs are inventoried monthly, and an annual tightness test is conducted. The Seattle ANGS has not experienced any known leaks in these USTs. An inventory of Seattle ANGS USTs is included in Table 1.2.

Table 1.2
UST Inventory
143rd CCSQ, Seattle ANGS, Seattle, Washington

Tank No.	Contents	Capacity (gallons)	Construction Material	Status	Year Installed	External Protection
202-1	MOGAS	5,000	Steel	Active	1983	Cathodic
202-2	Diesel Fuel	5,000	Steel	Active	1983	Cathodic
202-3	Diesel Fuel	5,000	Steel	Active	1983	Cathodic
202-4	Used Oil	550	Steel	Active	1983	Paint
202-5	Oil/Water Separator	720	Concrete	Active	1983	Paint
UNK	Diesel	2,000	UNK	Removed 1983	UNK	UNK
UNK	MOGAS	4,000	UNK	Removed 1983	UNK	UNK
UNK	UNK	2,000	UNK	Removed 1983	UNK	UNK
UNK	UNK	UNK	UNK	Removed 1983	UNK	UNK

MOGAS - Motor gasoline UNK — Unknown

1.2.5 Surrounding Property Environmental History

The adjacent properties on three sides of Seattle ANGS are zoned for general industrial use, are currently used for industrial purposes, and have a history of industrial use. The properties directly east, southeast and southwest of the Station are either owned by the Boeing Company (Boeing) or leased by Boeing from King County. The property immediately north of the Station is utilized by several large trucking firms and the State of Washington auto maintenance facility, while the area west/northwest of the Station, across Ellis Avenue South, consists of residential properties (Figure 1.4).

A former power plant owned by Seattle City Light, which is currently vacant, is located approximately 200 feet northeast of the Seattle ANGS, adjacent to the Boeing property. This

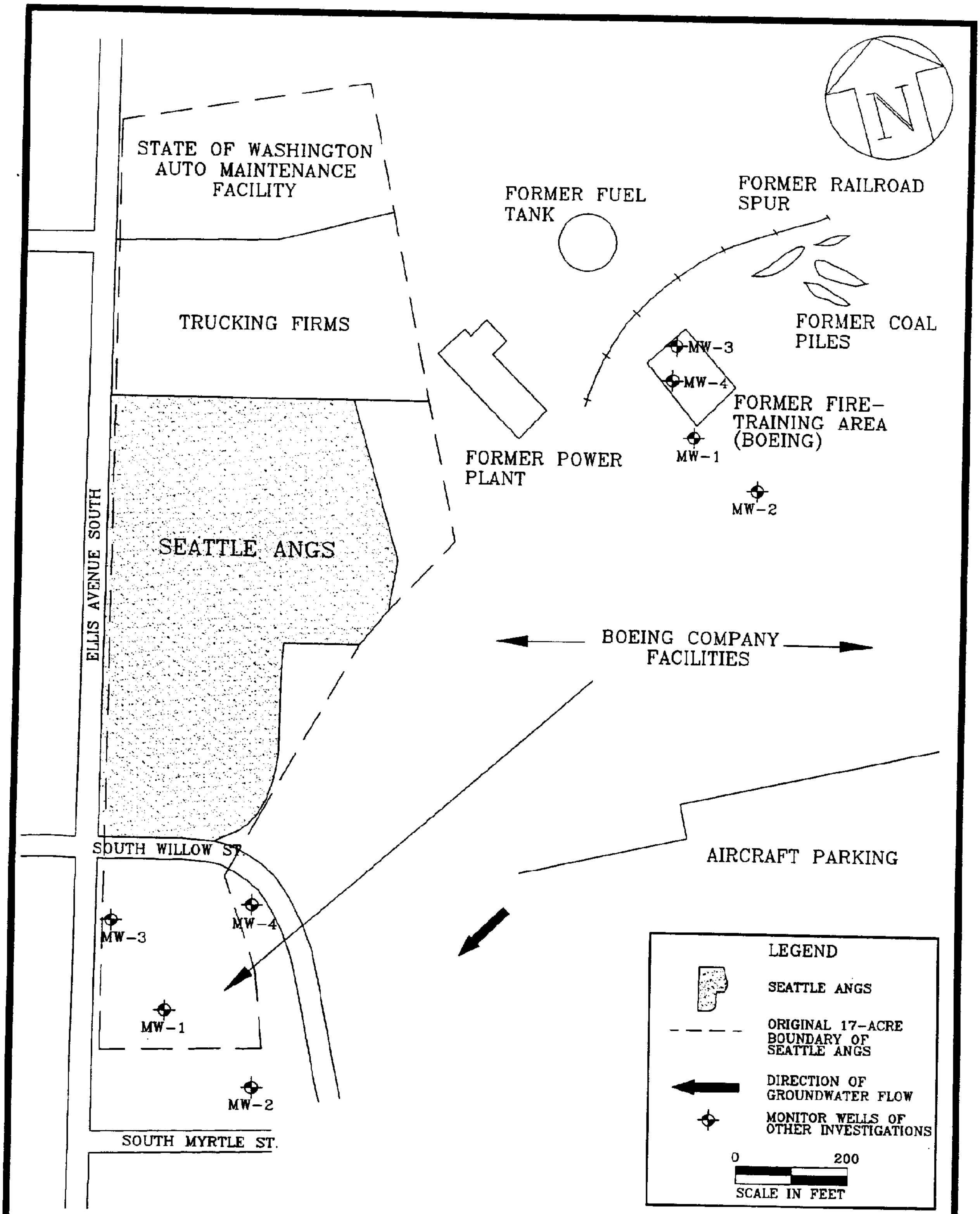

FIGURE 1.4

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AREAS OF ENVIRONMENTAL CONCERN IN VICINITY OF SEATTLE ANGS
143rd CCSQ, Seattle ANGS
Seattle, Washington

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APRIL 1994

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power plant was constructed in the 1890s and apparently used both coal and fuel oil in its operation. A 1946 aerial photograph interpretation shows a railroad spur, several large coal piles, and a large fuel oil tank in close proximity to the former power plant (Landau Associates, Inc., 1992). The large fuel oil tank (demolished in 1987) and the former coal piles were located upgradient from the Seattle ANGS, approximately 550 feet and 600 feet, respectively (see Figure 1.4).

A former fire-training area (FTA), the North Boeing Field Fire Training Center, was also located in close proximity to the former power plant. The former FTA, located approximately 550 feet upgradient (east) of the Seattle ANGS, was developed between 1960 and 1965. The FTA consisted of a rectangular-shaped earthen impoundment measuring approximately 140 feet by 100 feet and was used for fire-training exercises until late 1991 (see Figure 1.4). An investigation of the FTA was conducted by Landau Associates in July 1992. Soil sampling determined that, while petroleum hydrocarbon levels in some soil samples exceeded State cleanup levels, the impacts are limited to the boundaries of the fire-training pit and an area near the catchment basins designed to contain runoff from training activities. Analyses of groundwater samples detected several metals at concentrations well below cleanup levels, except for arsenic at 9 micrograms per liter (μg/L) in well MW-3 and at 11 μg/L in well MW-4 (the cleanup level for arsenic is 5 μg/L). Based on the low concentrations of arsenic detected, and the pattern of distribution, the occurrence of arsenic above cleanup levels appear to be more reflective of natural conditions, or of background concentrations in an industrialized area, than attributable to a release from the site (Landau, October 1992).

A recent investigation conducted at North Boeing Field centered on the Boeing main fuel farm located approximately 2,500 feet southeast of the Seattle ANGS (Seacor, September 1992). This investigation revealed the presence of dissolved hydrocarbons in groundwater in excess of cleanup levels from several of the surrounding monitor wells. However, due to the fuel farm's location in relation to the Station, groundwater from this site is not anticipated to impact Station property.

Another investigation conducted by Seacor in February 1992 centered on a tract of Boeing property, bounded by South Willow Street to the north and South Myrtle Street to the south, adjacent to Seattle ANGS. Analysis of groundwater samples from four monitor wells on the tract detected TPH above action levels in two wells (1.4 mg/L in MW-1 and 4.6 mg/L in MW-4), and trichloroethane above action levels was detected in one monitor well (1,000 μg/L in MW-1). During investigations conducted in the North Boeing Field area, groundwater is typically encountered between 5 to 10 feet BLS, with groundwater flow west/southwest toward the Duwamish Waterway.

1.2.6 PA Conclusions/Recommendations

The information obtained from the interviews and records search indicated that there is one potential AOC at Seattle ANGS, namely the Burial Site AOC (see Figure 1.3). This area was selected due to past practices involving the disposal of hazardous materials which could affect soil or groundwater at this location. The presence or absence of contamination from these past practices will be confirmed at the AOC in the SI.

Due to the nature of both past and present activities conducted at sites surrounding the Station, especially those upgradient from the Station, the possibility that contaminants may have migrated onto Station property cannot be discounted.

1.3 GENERAL SITE INSPECTION APPROACH

The site inspection at Seattle ANGS will include a geophysical survey, a soil vapor survey, the installation of soil borings for the collection of soil samples, and the installation of piezometer wells. The geophysical survey will be performed to detect items which are still present in the subsurface due to burial activities. Soil borings will be installed to determine if subsurface soil contamination exists at the AOC. Piezometer wells will be installed to determine groundwater flow direction.

The PA/SI Final Report will detail all activities and investigative findings, and will include data and analytical results obtained from the field investigation to support either no further action, or the identification of the AOC as requiring further investigation through an RI/FS.

1.4 WORK PLAN STRUCTURE

The work plan provides a description of the activities for the PA/SI and is organized into fourteen sections and five appendices.

Section 1.0	**Introduction,** defines the purpose and scope of the site inspection and provides a description of the PA which was performed at the Station.
Section 2.0	**Project Management Approach,** provides a description of the project management plan for the execution of this project.

Section 3.0	**Facility Background Information,** provides background information on the environmental setting of Seattle ANGS, and the AOC which is the subject of this inspection.
Section 4.0	**Permit Requirements,** provides information on applicable permit requirements for the site inspection of the AOC in this work plan.
Section 5.0	**Investigative Approach,** describes the overall approach and the specific site inspection activities for the AOC.
Section 6.0	**Field Sampling Plan,** describes in detail the procedures used for each applicable investigative method and field screening technique.
Section 7.0	**Sample and Data Collection Procedures,** describes specific protocols to be implemented in retrieving, handling, and storing environmental samples, as well as the methodology protocols for obtaining other site inspection data.
Section 8.0	**Equipment Decontamination Procedures,** describes the procedures for cleaning sampling equipment.
Section 9.0	**Borehole Abandonment Procedures,** describes the procedures for properly abandoning soil borings.
Section 10.0	**Site Inspection Derived Waste Handling Procedures,** addresses the handling, storage, classification, and disposal and/or treatment of wastes produced during the site inspection.
Section 11.0	**Summary of Applicable or Relevant and Appropriate Requirements,** provides a brief description of applicable or relevant and appropriate requirements (ARARs).
Section 12.0	**Project Schedule for PA/SI,** presents the project time frame for accomplishing the required PA/SI.
Section 13.0	**PA/SI Final Report,** presents the structure of the PA/SI report with an annotated PA/SI Final Report outline.

Section 14.0	**References,** provides a listing of references used in preparation of the PA/SI work plan.
Appendix A	Presents emergency health and safety information for the field work at Seattle ANGS.
Appendix B	Presents the procedures for calibrating and maintaining field equipment.
Appendix C	Presents the data elements required to score Federal Facility Docket Sites under the United States Environmental Protection Agency (USEPA) HRS program.
Appendix D	Presents probe and boring logs from previous geotechnical investigations at the Seattle ANGS.
Appendix E	Presents soil vapor survey procedures to be followed at Seattle ANGS.

Section 2

SECTION 2.0 PROJECT MANAGEMENT APPROACH

2.1 PROJECT MANAGEMENT ORGANIZATION

The project will be managed and executed by personnel selected by the contractor who will ensure that the objectives of the PA/SI are met. Soil vapor surveys, drilling and well installation, analytical services, and surveying support will be provided by subcontractor firms experienced in performing their specific assigned tasks, and which possess the required permits, licenses and accreditations necessary to work in Washington. An example project management organization is shown in Figure 2.1.

The contractor project team will include the following key professionals:

The Program Manager will be responsible for the overall execution of this project and for maintaining an open line of communication with the ANGRC/CEVR Project Manager.

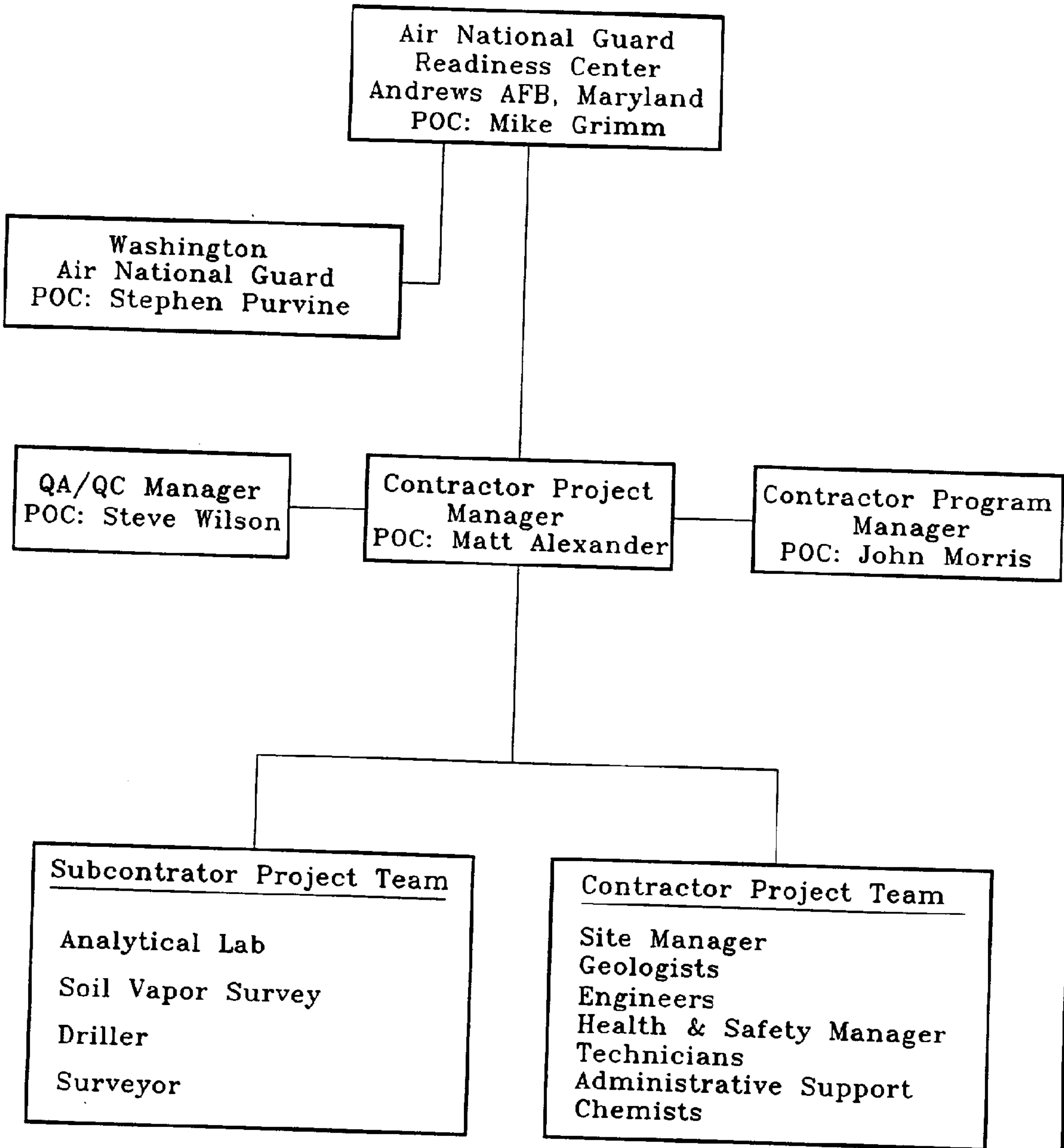
The Project Manager will directly supervise the project team, provide technical direction, direct field operations, and coordinate contractor and subcontractor support. The Project Manager will be the technical interface between the ANGRC and the project team.

The Site Manager will directly supervise the field investigation project team and provide technical direction and technical interface with the Project Manager.

The Quality Assurance/Quality Control (QA/QC) Manager will be responsible for developing standardized quality assurance procedures for this project, and for ensuring that effective procedures and controls are implemented to achieve a high level of project accuracy.

The Health and Safety Manager will be responsible for assuring that physical and chemical hazards will be appropriately mitigated through effective execution of the Health and Safety Plan (HSP).

Project Scientific Personnel will include qualified geologists, engineers, and other specialties required to conduct the PA/SI.



SOURCE: OPTECH, 1993.

FIGURE 2.1

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PROJECT MANAGEMENT ORGANIZATION
143rd CCSQ Seattle ANGS
Seattle, Washington

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OPERATIONAL TECHNOLOGIES CORPORATION
JANUARY 1994

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2.2 PROJECT PROCEDURES

An open line of communication will be maintained between the Project Manager and the project team to ensure that all project objectives are met. Verifiable sample custody will be an integral part of the field work. Samples will be properly collected and identified. All sampling activities will be carried out in accordance with the OpTech Corporate Environmental Quality Assurance/Quality Control Plan (CEQP). All information pertinent to field observations, screening and sampling will be indelibly recorded in a bound field notebook. Each member of the project team will maintain a field notebook in which details of daily field activities will be recorded. A copy of each daily log entry will be placed in the project file. The field notebooks will, at a minimum, contain the following information for this project: date, time, and type of activity; names and affiliations of persons on site; weather conditions; sampling and preservation procedures; sampling locations, depths, and conditions; time of sampling and sample description; remarks; and signature of author.

2.3 QUALITY MANAGEMENT

The QA/QC Manager will be responsible for ensuring all QC procedures are followed. Immediate corrective actions will be taken at any time they are deemed necessary. All quality control procedures will be directed in accordance with the CEQP.

2.4 SUBCONTRACT MANAGEMENT

The contractor is responsible for the cost, schedule, and quality of all work performed under this contract delivery order, including the work of subcontractors. The contractor may elect to hire subcontractors for the soil vapor survey, drilling, analytical services, and surveying support. These subcontractors will support the contractor efforts at Seattle ANGS and will be selected through a fair and competitive procurement process. The contractor Project Manager will maintain oversight of the subcontractor completion of specified tasks with respect to technical performance, quality, and adherence to cost and schedule. All subcontractor activity will be in compliance with the CEQP and OpTech HSP prepared for the PA/SI.

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Section 3

SECTION 3.0 FACILITY BACKGROUND INFORMATION

3.1 FACILITY DESCRIPTION

Seattle ANGS is located at 6736 Ellis Avenue South, Seattle, Washington. The Station property is situated northeast of the intersection of Ellis Avenue South and Willow Street. The Station encompasses approximately 7.5 acres of flat terrain and is located in the northwest portion of Boeing Field (King County International Airport) (see Figure 3.1).

As shown in Figure 1.3, Seattle ANGS consists of a Communications/Administration Building (Building 201), an AGE/Motor Vehicle Building (Building 202), a Paint Storage Building (Building 203), and Mobility Storage (Building 204).

Seattle ANGS has a normal working population of 24 people. The station serves as a site for Unit Training Assembly (UTA) which meets one weekend per month. During this weekend, the station population reaches approximately 158.

3.2 DESCRIPTION OF AREA OF CONCERN

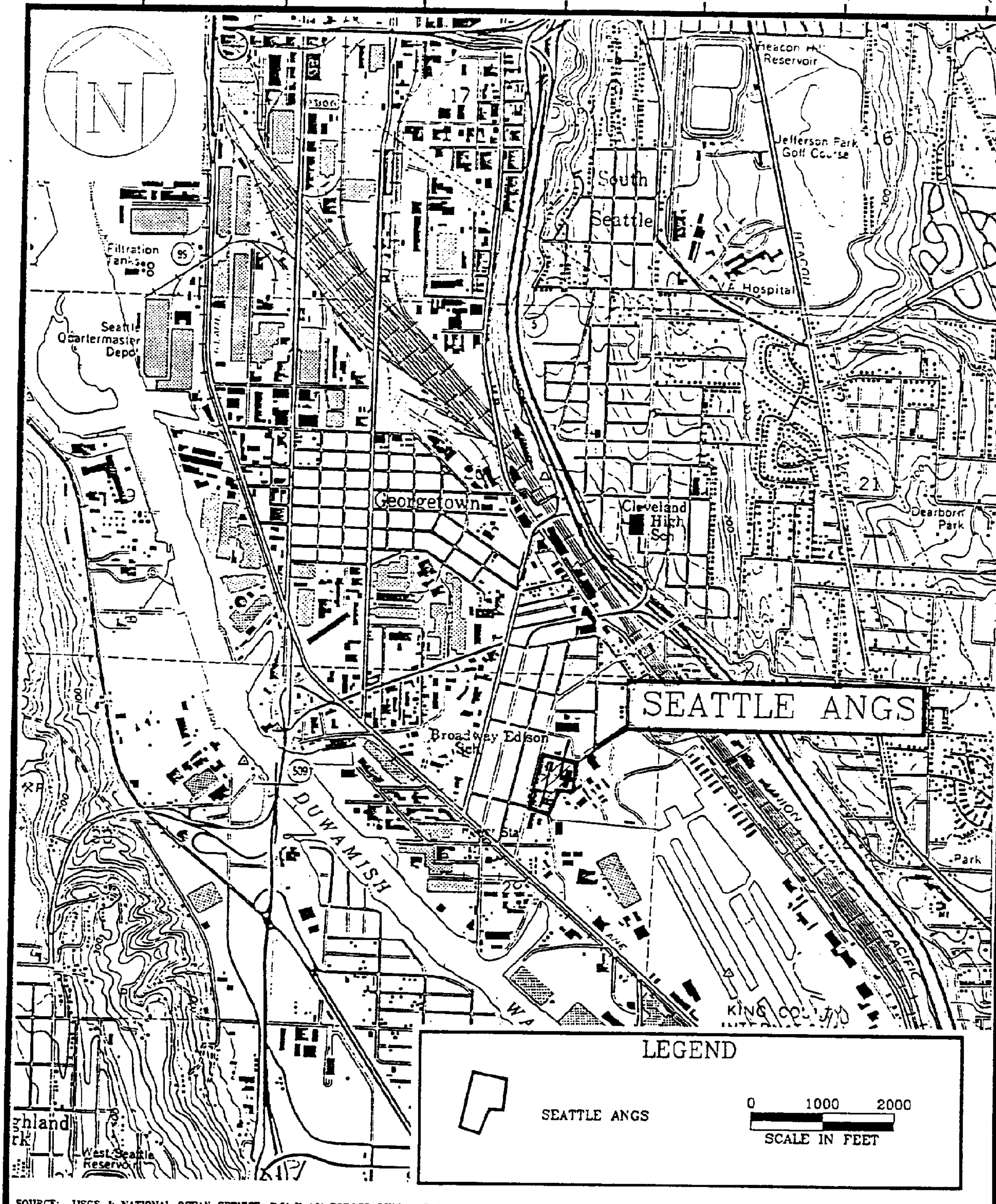
3.2.1 Burial Site AOC - Background and Operational History

The Burial Site AOC is located in the northeast corner of Seattle ANGS, approximately 70 feet east of Building 202, the AGE/Vehicle Maintenance Building (see Figure 1.3). The site measures approximately 160 feet in length with an average width of 150 feet. A 6-foot-high security fence bounds the site to the north and east. The majority of the site is covered with asphalt and used for vehicle parking, with the exception of the northeast corner, which is covered with grass.

From the early 1950s to 1968, various waste items were burned and buried in the area northeast of the old gravel parking lot. The probable wastes associated with this site include radio tubes, solvents, waste motor oils, kerosene, batteries, brake fluid, spray paints, paint thinners and removers, MEK, xylene, and naphtha.

3.2.2 Burial Site AOC - Review of Existing Sampling Data

No previous sampling data exists for this AOC.



SOURCE: USGS & NATIONAL OCEAN SERVICE, 7.5' X 15' TOPOGRAPHIC – BATHYMETRIC QUADRANGLE MAP SOUTH SEATTLE, WASHINGTON, 1983.

FIGURE 3.1

P\SEATTLE\SEA4-1LO

7.5' X 15' TOPOGRAPHIC MAP
143rd CCSQ, Seattle ANGS
Seattle, Washington

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3.3 ENVIRONMENTAL SETTING

Seattle ANGS is located in King County in the Puget Sound Lowlands physiographic province (see Figure 3.2). The Puget Sound Lowlands is a north-south trending structural and topographic depression bordered on the west side by the Olympic Mountains and on the east by the Cascade Range. The Lowlands extend north from the Oregon-Washington State line to the Canadian border.

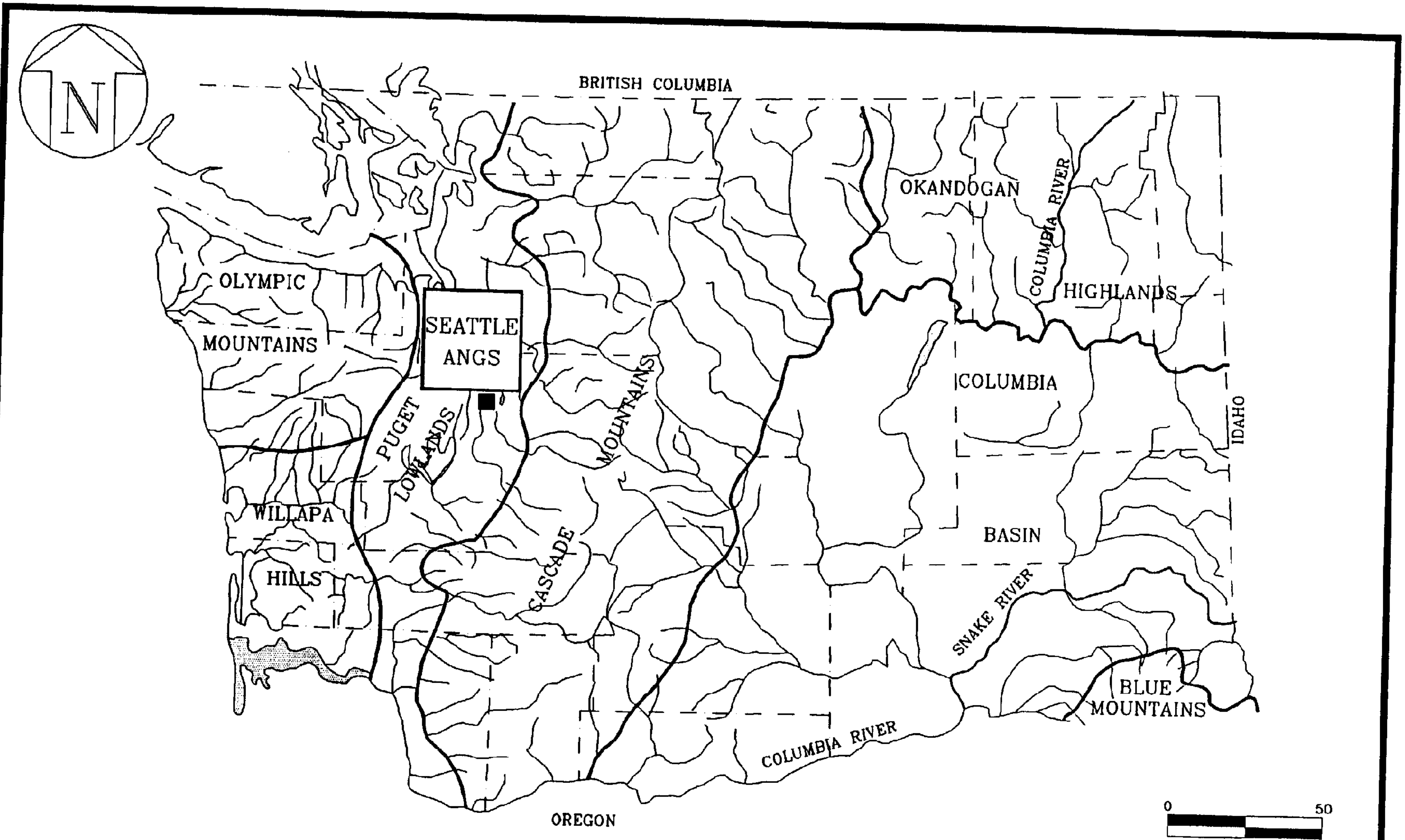
3.3.1 Geology

The Seattle ANGS is situated in the southern portion of the Puget Sound Lowlands, a broad, relatively level glacial drift plain that is dissected by a network of deep marine embayments. The site is located within the north-south trending Duwamish Valley on the Duwamish Waterway floodplain, formerly a marine embayment that has been filled with sediment since the end of the last glaciation, referred to as the Vashon Glaciation of Pleistocene age (Luzier, 1969). The Station is located on flat terrain within the flood plain of the Duwamish River, with a surface elevation of approximately 4 feet above mean sea level (MSL). The valley is bounded to the east and west by uplands. Figure 3.3 is a geologic map of the area, and Figure 3.4 shows a stratigraphic column for the Puget Sound Lowlands.

Sediments (collectively termed Vashon Drift), representing the last major advance and retreat of glacial ice into the Puget Sound area, commonly overlie the sequence of older glacial and nonglacial sediments throughout the site vicinity. In the North Boeing Field area, at least 75 feet of recent alluvium deposited by the Duwamish River is underlain by Vashon Drift deposits. Alluvial deposits are composed primarily of sand and silty sand interbedded with silt. The alluvial deposits exhibit gradation common to braided rivers which have resulted in intermittent layering of sands with occasional layers of peat and organic materials being deposited in previous low-lying marsh areas. Additionally, much of the valley floor has been raised with more recent fill to accommodate development within the valley.

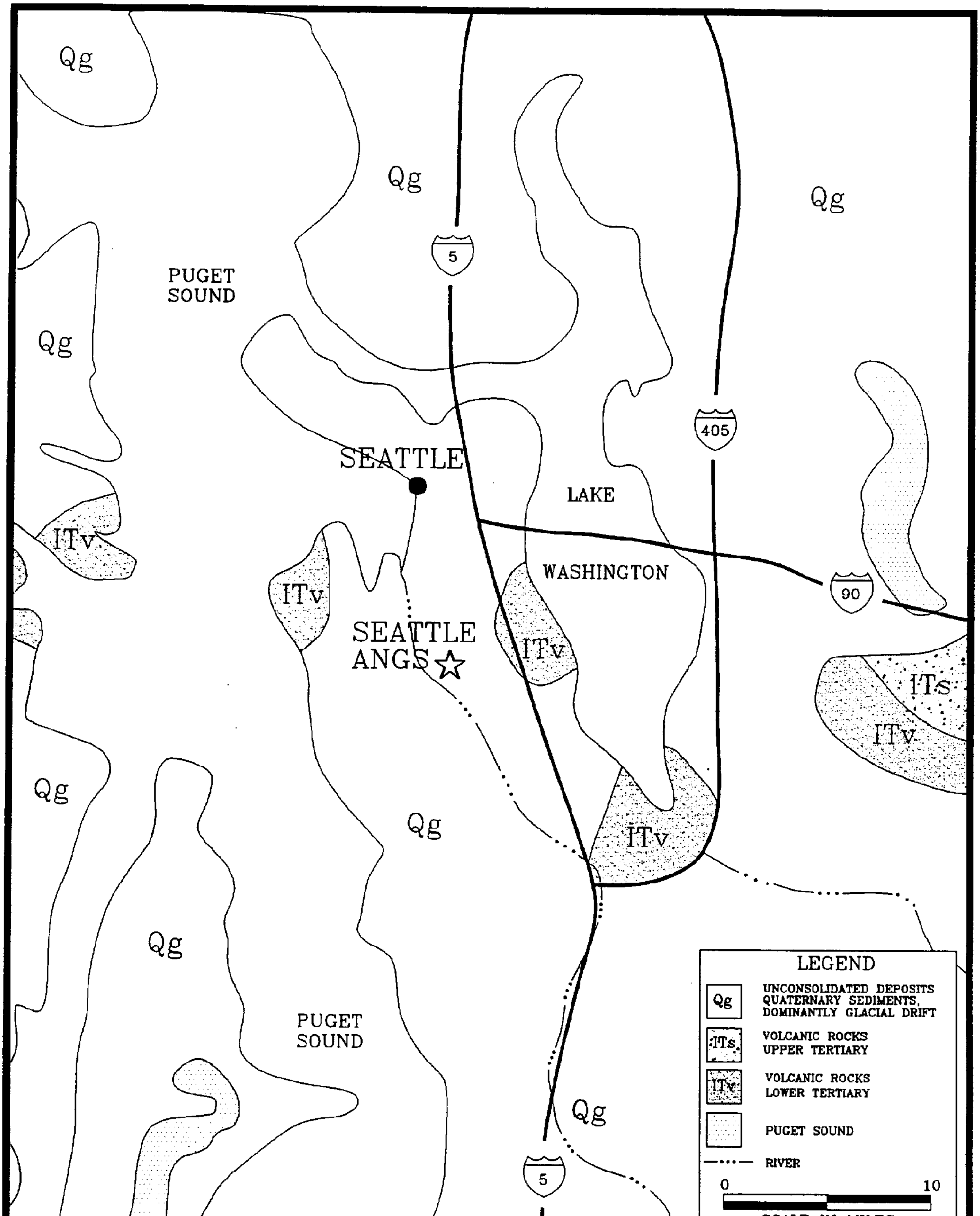
3.3.2 Soils

The United States Department of Agriculture classified the soil underlying the Seattle ANGS as unclassified urban land. Urban land is soil that has been modified by disturbance of the natural layers with additions of fill material several feet thick to accommodate large industrial and housing installations. In the Duwamish River Valley, the fill ranges from about 3 to more than



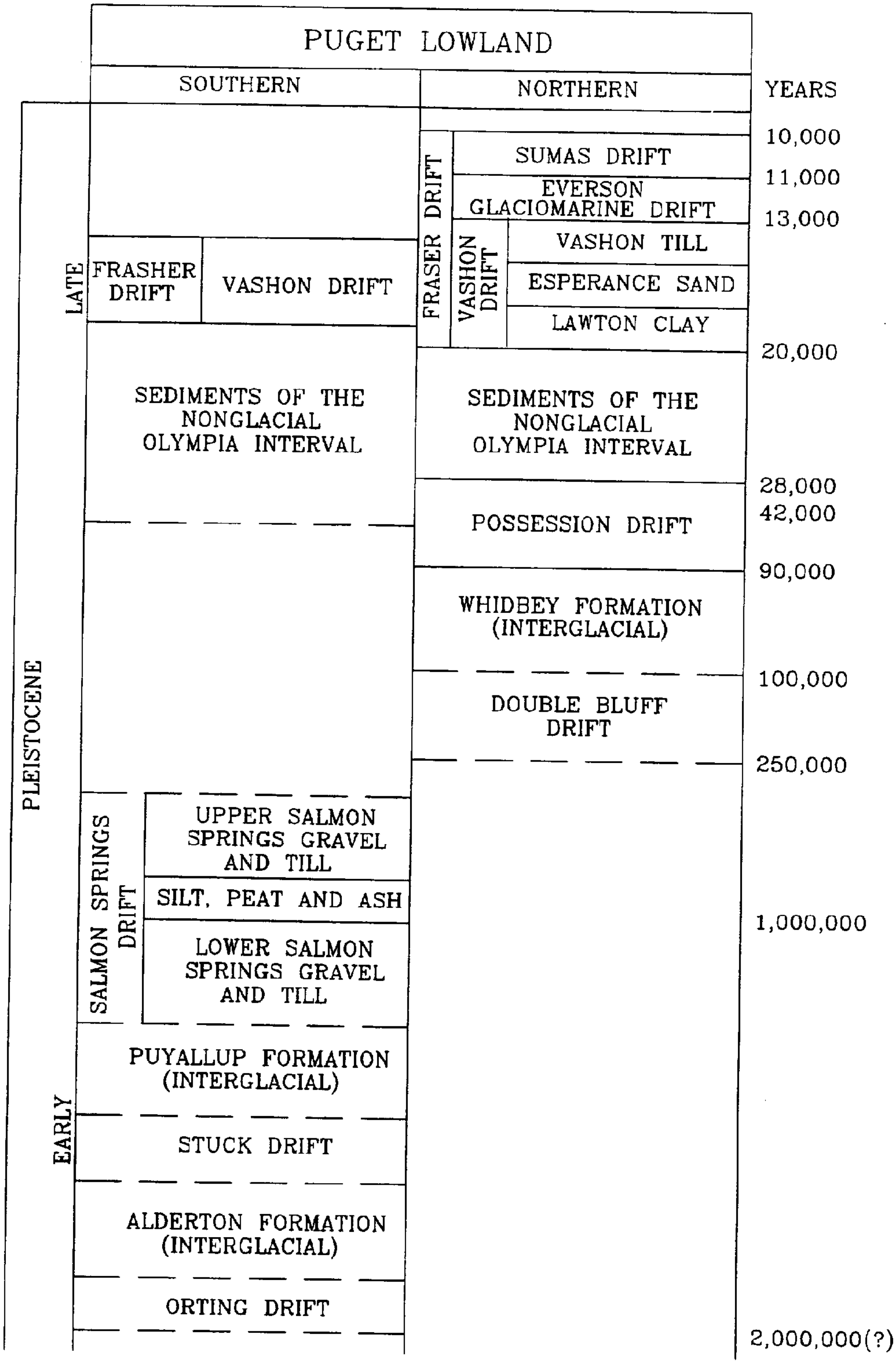
SOURCE: AGNEW AND BUSCH, 1961.

FIGURE 3.2	PHYSIOGRAPHIC DIVISIONS OF THE STATE OF WASHINGTON 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION
SEA4-3PH		JANUARY 1994



SOURCE: WASHINGTON STATE DEPARTMENT OF NATURAL RESOURCES, 1992.

FIGURE 3.3	GEOLOGIC MAP OF THE VICINITY OF SEATTLE ANGS	OPTECH
SEA-SOIL	143rd CCSQ, Seattle ANGS Seattle, Washington	OPERATIONAL TECHNOLOGIES CORPORATION APRIL 1994



SOURCE: BLUNT, DONALD J., 1987.

FIGURE 3.4

SEA4-5GE

GENERALIZED STRATIGRAPHIC COLUMN FOR THE PUGET SOUND LOWLANDS
143rd CCSQ, Seattle ANGS
Seattle, Washington

OPTECH
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JANUARY 1994

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12 feet thick, and from gravelly sandy loam to gravelly loam in texture. The erosion hazard is slight to moderate.

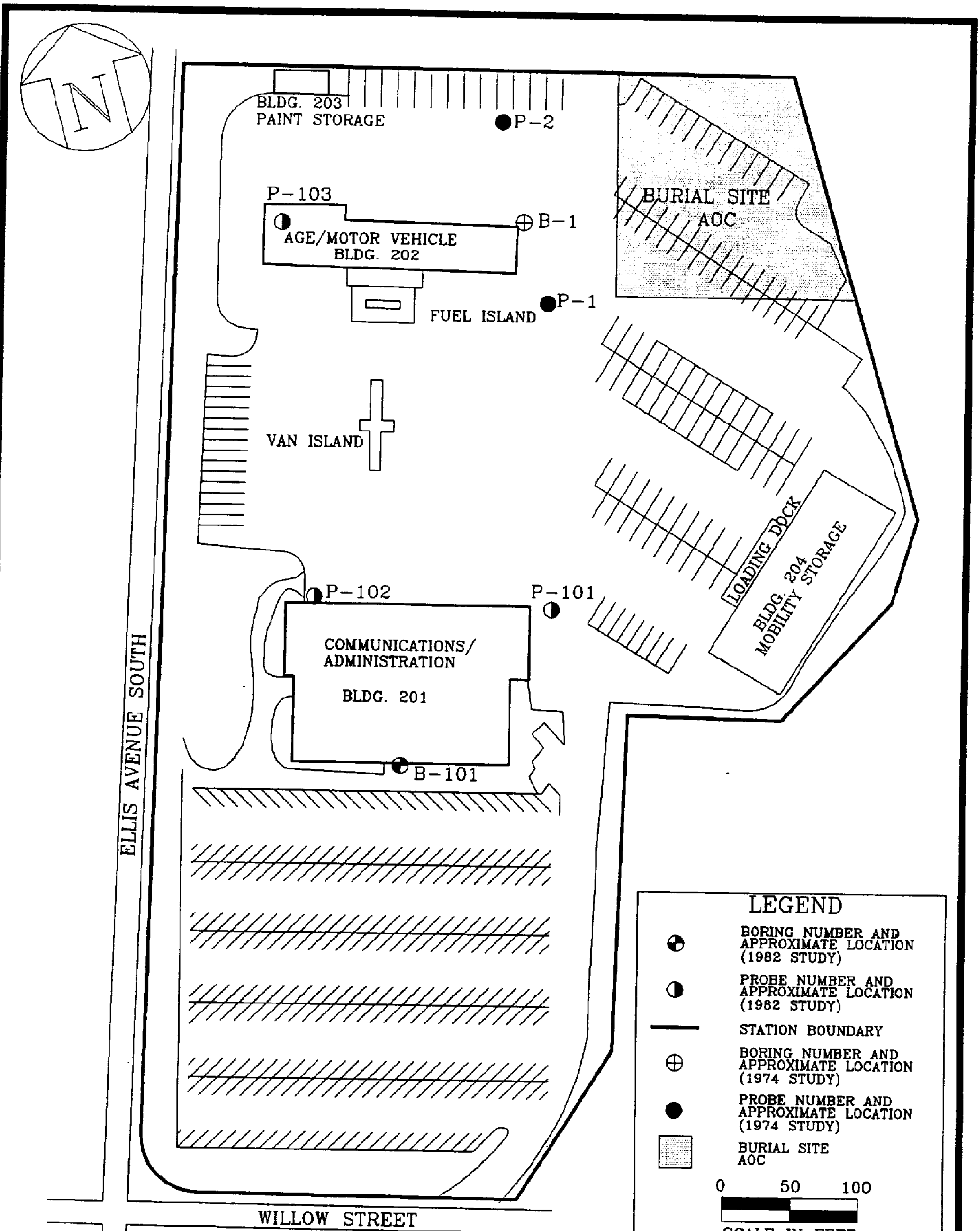
Five Dutch cone penetrometer samples (hereinafter referred to as probes) and two borings, drilled by Hart Crowser and Associates, Inc. during soil studies conducted in 1974 and 1982 at Seattle ANGS, show sandy silt to silty sand to be the most common soil within the uppermost 10 feet of unconsolidated sediments, below which sand, with occasional thin silty layers, is the predominant soil type to a depth of 50 feet below land surface (BLS). The Dutch cone penetrometer is an instrument used in geotechnical investigations to measure soil strength. The system is mounted on a truck and a probe driven into the ground. A direct correlation is obtained between the point resistance of the cone and bearing capacity of the soil, and the relative density or consistency of the soil is then calculated. The location of the probes and borings are indicated on Figure 3.5. Detailed logs of the five probes and two borings are presented in Appendix D.

3.3.3 Surface Water Hydrology

The Seattle ANG Station is located approximately a quarter mile from the main channel of the Duwamish Waterway, a major surface water drainage basin for western Washington (see Figure 3.6). Between 1917 and 1919, the meanders of the Duwamish River were filled in and the Duwamish Waterway was constructed. The western end of the meander near North Boeing Field was not filled and became the present day Slip No. 4. The Federal Emergency Management Agency (FEMA) reported the drainage basin of the Duwamish as 450 square miles. The Waterway is composed of the Duwamish and the Green Rivers. Approximately 5.5 miles downstream of the Station the Duwamish discharges into Elliot Bay on the Puget Sound. The Seattle Water Department indicated the Duwamish Waterway is not used by them for drinking water and is the only fresh water downgradient of the Station. Surface water drainage is totally controlled by man-made drainage systems which are routed into the municipal storm sewer. Figure 3.7 illustrates the storm drain systems on the Station.

3.3.4 Hydrogeology

Groundwater at shallow depths occurs at Seattle ANGS under water-table conditions within the upper part of the recent river alluvium. Investigations have found that groundwater is influenced by seasonal precipitation and tidal fluctuations, and may exhibit a southern and/or northern trend. Groundwater was encountered at a depth of approximately 5 feet BLS in January 1982



SOURCE: HART-CROWSER & ASSOCS, INC., JANUARY 1982.

FIGURE 3.5 SEA4-6LO	LOCATION OF PREVIOUSLY DRILLED PROBES AND BORINGS 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

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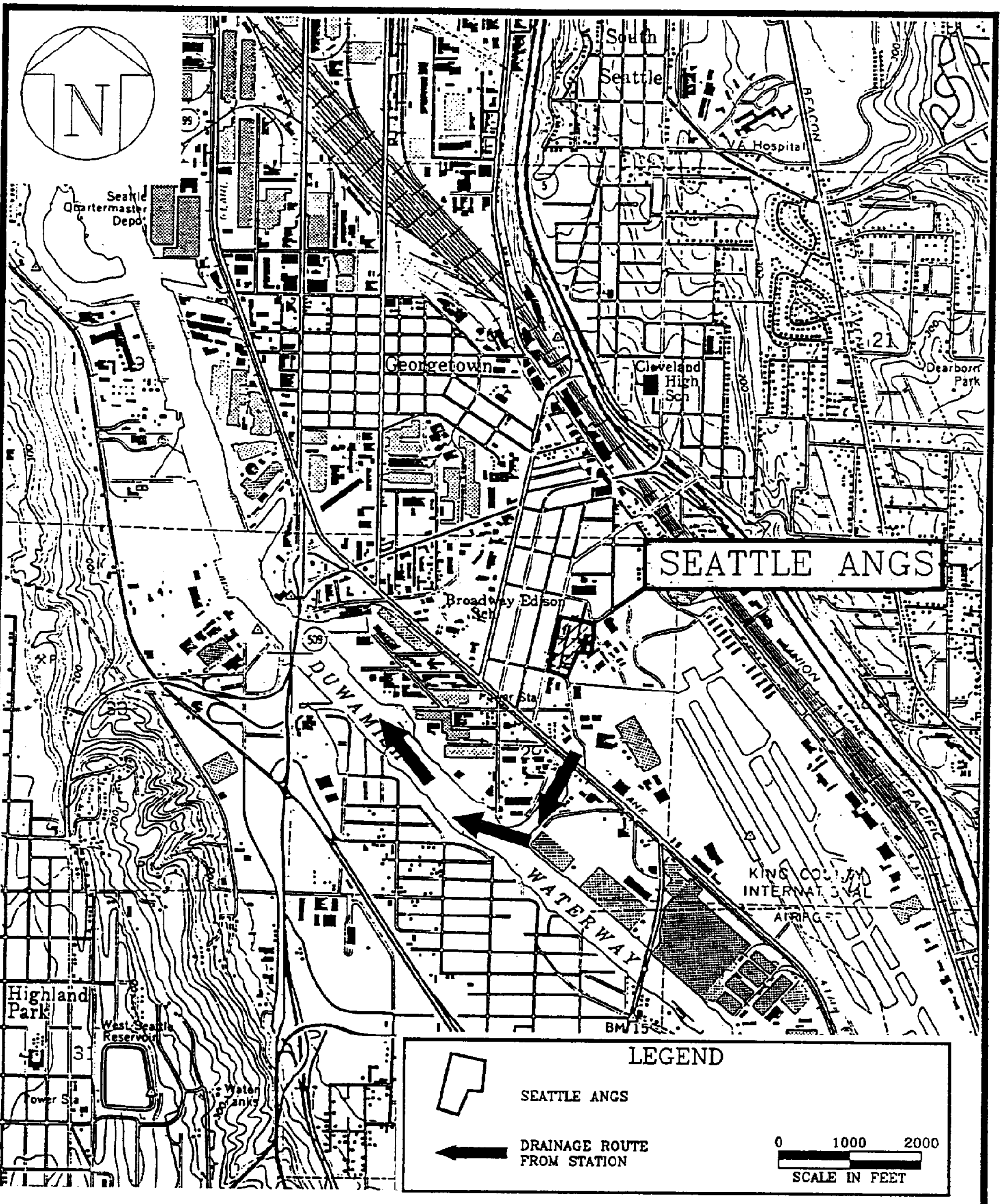

SOURCE: USGS & NATIONAL OCEAN SERVICE, 7.5' X 15' TOPOGRAPHIC - BATHYMETRIC QUADRANGLE MAP SOUTH SEATTLE, WASHINGTON, 1983.

FIGURE 3.6 P:\SEATTLE\SEA4-11.0	DRAINAGE PATTERN IN VICINITY OF SEATTLE ANGS 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION APRIL 1994

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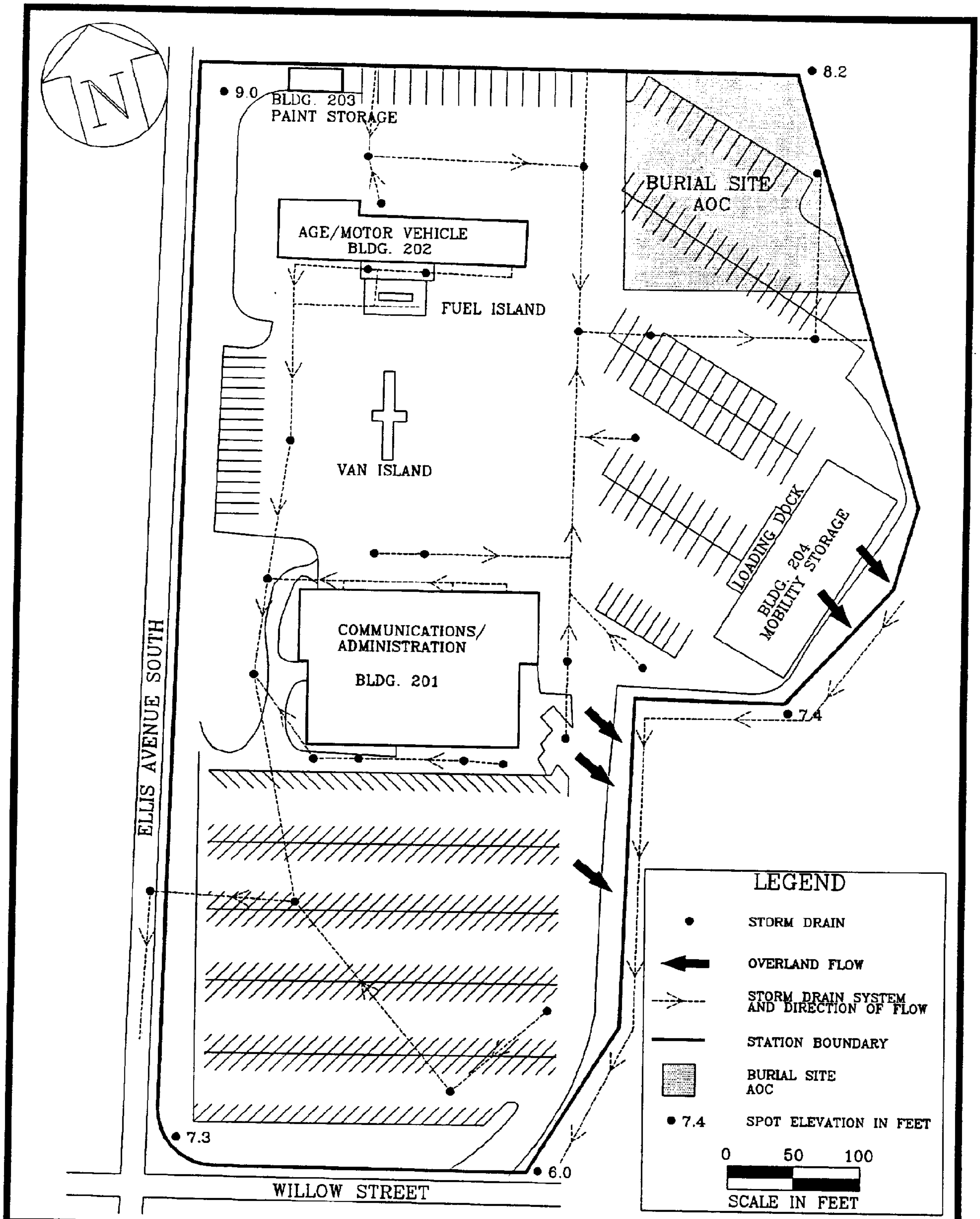

FIGURE 3.7

P\SEATTLE\SEA4-8SU

SURFACE WATER DRAINAGE MAP
143rd CCSQ, Seattle ANGS
Seattle, Washington

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and 11 feet BLS in October 1974 during Station projects conducted by Hart Crowser and Associates, Inc. These measurement dates reflect the dry and wet seasons in the region. Several investigations undertaken by Seacor and Landau Associates, on behalf of Boeing at North Boeing Field, have found groundwater in the area to occur at shallow depths under normal water-table conditions. Groundwater is generally encountered at depths between 4 and 10 feet BLS (Seacor, December 1992). Groundwater flow is generally to the west/southwest, toward the Duwamish Waterway, at a gradient of approximately 0.002 feet per foot. Data compiled from monitor wells developed as a result of an investigation at North Boeing Field show that static water levels ranged from 7.53 to 10.00 feet in the immediate vicinity of the Station (Seacor, February 1992). Another investigation conducted at North Boeing Field showed that stabilized depth to groundwater in monitor wells prior to sampling ranged from 6.95 to 8.74 feet (Seacor, September 1992).

Deeper groundwater is reported by Luzier (1963) beneath the river alluvium in the unconsolidated glacial deposits. Characteristics of the deeper groundwater aquifer are unknown, though groundwater probably flows toward the Duwamish Waterway and thus to Elliot Bay.

The Seattle Water Department indicated that no municipal wells were within four miles of the Station, and records obtained from the Washington Department of Ecology (DOE) Water Resources Department revealed no private drinking water wells within a one-mile radius of the Station. The surrounding population obtains drinking water from municipal water.

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Section 4

SECTION 4.0 PERMIT REQUIREMENTS

4.1 WASHINGTON STATE PERMIT REQUIREMENTS

The Washington Department of Ecology requires a permit for installation of groundwater monitoring wells. Separate permits will also be required for soil borings and peizometer well activities conducted at the site. The permit application/notification must be completed and the fee paid prior to the beginning of work. The application/notification is normally the responsibility of the drilling contractor.

SI activities involving the movement or removal of hazardous waste must be in compliance with Resource Conservation and Recovery Act (RCRA) and State requirements as outlined in Section 11.0. Drillers and surveyors, subcontracted for work during the SI at Seattle ANGS, must be licensed and registered in accordance with State of Washington requirements.

4.2 STATION PERMIT REQUIREMENTS

Digging permits are required from the 241st Civil Engineering Squadron (CES) at Camp Murray prior to conducting soil vapor surveys and the installation of soil borings or piezometer wells. Once these locations have been staked, the Camp Murray ANGS Civil Engineer and Station personnel will inspect and approve the locations.

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Section 5

SECTION 5.0 INVESTIGATIVE APPROACH

5.1 WORK PLAN OBJECTIVES

The objective of this work plan is to communicate to all involved parties (ANGRC, the Station environmental coordinator, Seattle ANGS, subcontractors, and regulatory agencies) the planned approach and details of the site inspection of the AOC at Seattle ANGS. The work plan will also serve as the primary guidance document of the site manager and contractor project team during the site inspection.

5.2 GENERAL APPROACH

The suspected mode of contamination at the Burial Site AOC, as described in Section 3.2, is by intentional application to the ground surface, rather than by any pipe or tank leakage processes occurring underground. Since this practice was halted in 1968, the majority of the land surface has been asphalted and used as a parking lot. Therefore, ground-penetrating radar for locating the perimeter of the burial site, a soil vapor survey for initial screening, and the installation of soil borings and piezometer wells for soil and groundwater sample collection are the preferred methods for the conduct of the site inspection.

The soil vapor survey will be conducted prior to the installation of soil borings and will be used at the AOC as a screening tool for determining the optimum location of soil borings needed to confirm the absence or presence of soil contamination. The installation of soil borings will be conducted to determine soil background conditions, to screen for possible contamination, and to collect soil samples for analytical analysis. The installation of piezometer wells will be conducted to determine station-wide groundwater flow direction, to determine background groundwater quality, to screen groundwater for possible contamination, and to collect groundwater samples for laboratory analysis. As discussed in Section 3.3.4, groundwater is encountered from 4 to 10 feet BLS. Therefore, soil borings will be installed to 10 feet or to the first encounterance of groundwater, and peizometer wells will be installed to a depth of 20 feet BLS. The wells will have a 10-foot screen from 9 to 19 feet BLS, or the screen will be installed from 2 feet above to 8 feet below the depth groundwater is encountered.

5.2.1 Determining Background Levels

An evaluation of the significance of environmental contaminant concentrations is typically based on a comparison of the levels observed to known background conditions and regulatory-based standards, where applicable. Sampling of soil and groundwater at background locations will be conducted to determine naturally occurring concentration levels and contaminant or chemical concentrations already existing in the AOC due to general environmental conditions. Establishing soil and groundwater background conditions is necessary for risk assessment, establishing cleanup criteria, and making decisions on further site actions. The location chosen for background sampling is located away from any potential contamination source at the Station, and should provide information on background conditions applicable to the AOC.

Soil and groundwater samples, collected from piezometer well BS-004PZ, will serve as background data for the AOC under investigation. Samples will be collected and field screened at 5-foot intervals to characterize subsurface soil and geological conditions. One soil sample and one groundwater sample will be obtained for laboratory analysis from the piezometer well. Soil samples will be obtained from the surface and from immediately above the water-table. The planned piezometer well location is included in the following site-specific investigation program.

5.3 BURIAL SITE AOC

The Burial Site AOC was used for the burning and burial of various waste items which included radio tubes, solvents, waste oil, kerosene, batteries, brake fluid, spray paints, paint thinners and removers, MEK, xylene, and naphtha. This site inspection is to determine if contamination has occurred at this location as the result of these past waste disposal activities.

5.3.1 Geophysical Survey

A geophysical survey of the Burial Site AOC will be made prior to the soil vapor survey or the installation of soil borings. The survey will employ ground-penetrating radar (GPR) for the detection of subsurface metallic or non-metallic structures or anomalies.

The GPR will be used to locate large buried items, as well as to detect areas that may have been backfilled during dumping operations. A GPR transducer with an operating frequency of 500 megahertz (MHz) will be employed. This is the optimal frequency for detection of utilities, underground storage tanks, and subsurface voids. A grid spacing of 15 feet will be utilized for the survey (Figure 5.1).

5.3.2 Soil Vapor Survey

Prior to installation of soil borings, a soil vapor survey will be conducted at the Burial Site AOC to determine the optimum location of soil borings needed to confirm the absence or presence of

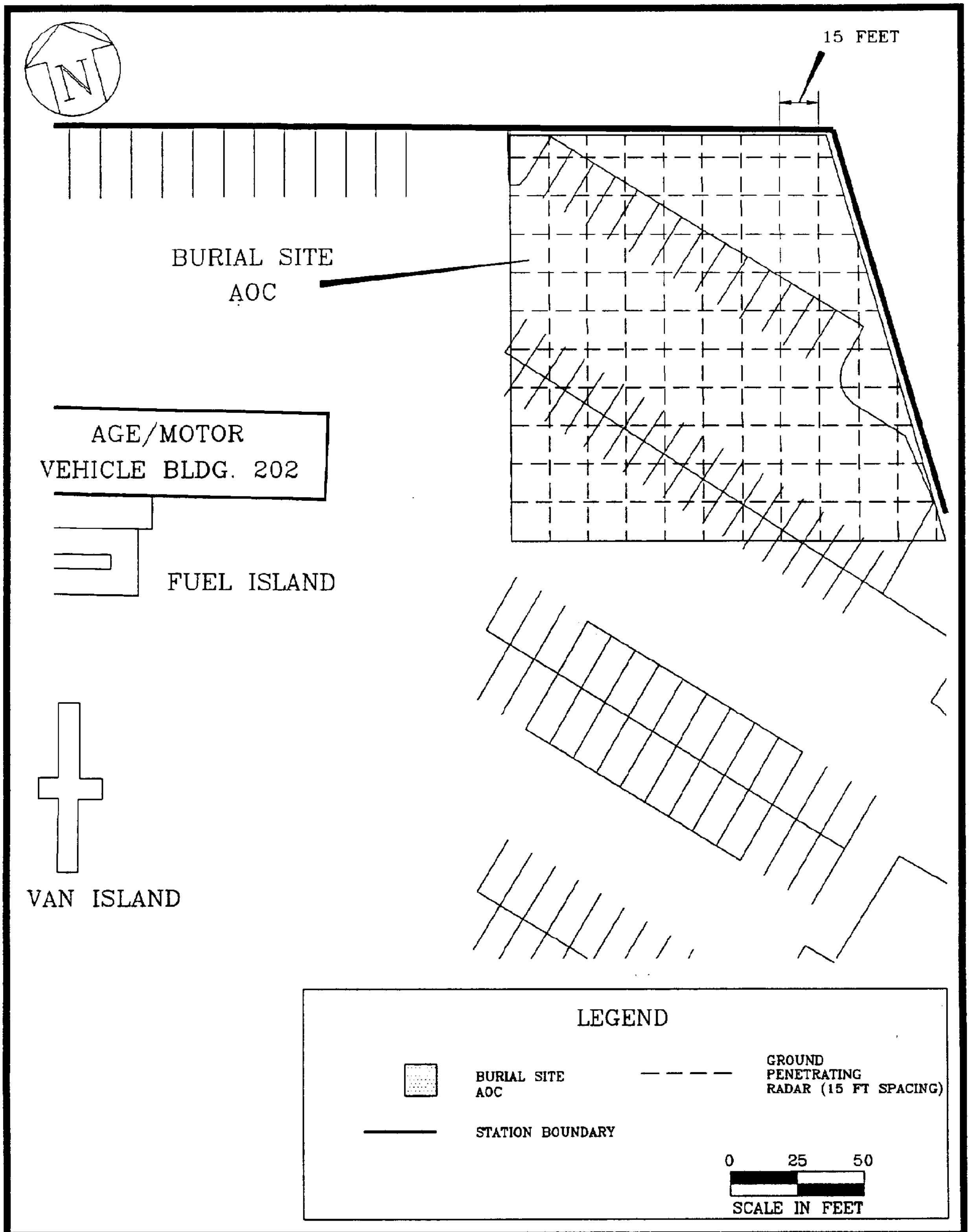

FIGURE 5.1

P\SEATTLE\GSP-AOC

BURIAL SITE AOC
GEOPHYSICAL SURVEY
143rd CCSQ, Seattle ANGS
Seattle, Washington

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contamination in soils associated with the hydrocarbon releases at this site. The location of these soil vapor sampling points are shown in Figure 5.2. A total of 21 sample points will be set up on a grid system with a distance of no more than 40 feet between sampling points. A soil vapor sample will be collected from a depth of approximately 5 feet BLS from each location. Based upon these in-field results, the site manager may recommend additional soil vapor samples, and/or determine the locations of soil borings to be installed.

5.3.3 Proposed Soil Boring Plan

Soil borings will be installed to determine if contamination exists at the AOC. Three soil test borings will be installed in the area of suspected waste disposal activities. The exact locations will be determined based on the results of the soil vapor survey. The proposed soil boring locations for the Burial Site AOC are shown on Figure 5.2. Soil boring BS-003BH will be sampled continuously from surface to water table for subsurface geological characterization. The proposed depth of boreholes is based on the depth to groundwater at the site (approximately 10 feet BLS) and is shown in Table 5.1, along with the sampling program.

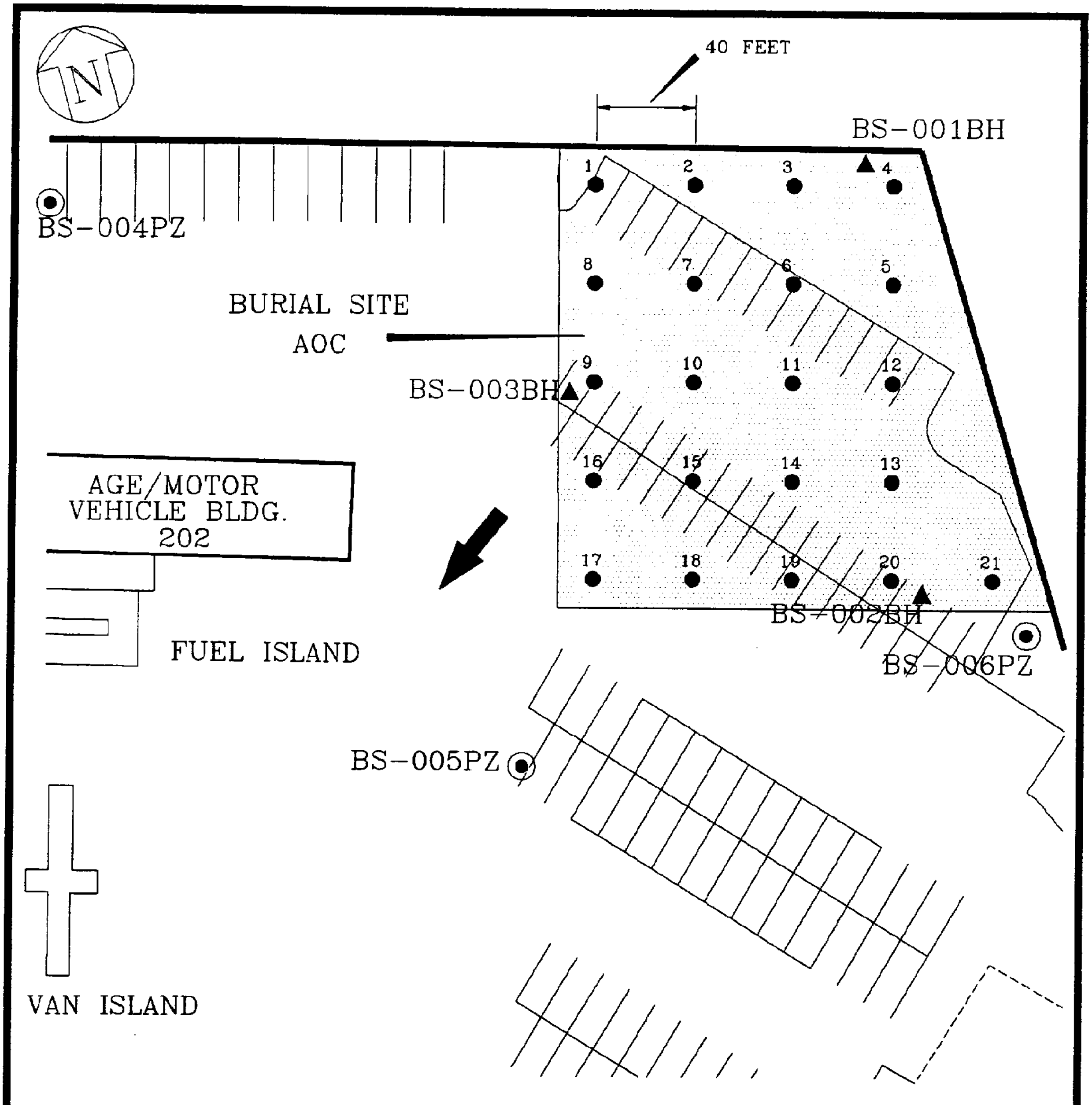
Soil samples will be obtained at intervals and by methods outlined in Section 7.1. Soil samples will be analyzed for the parameters described in Section 7.0, Table 7.1. The provisions of the Optech HSP and Appendix A will also apply throughout the sampling at this site.

Table 5.1
Burial Site AOC Inspection Summary
143rd CCSQ, Seattle ANGS, Seattle, Washington

Borehole or Piezometer Well	Approximate Drill Depth (Feet BLS)	Sample Type and Number of Samples	Screened Interval (Feet BLS)
BS-001BH	10	SS,3	N/A
BS-002BH	10	SS,3	N/A
BS-003BH	10	SS,3	N/A
BS-004PZ	20	BG/SS,1 BG/GW,1	N/A 9 - 19
BS-005PZ	20	GW,1	9 - 19
BS-006PZ	20	GW,1	9 - 19

BS — Burial Site
BG — Background Sample
SS — Soil Sample
GW — Groundwater Sample
PZ — Piezometer
BH — Borehole

BLS — Below Land Surface
N/A — Not applicable



LEGEND

▲	SOIL TEST BORING LOCATIONS	BS	BURIAL SITE	●	SOIL VAPOR SAMPLES (40 FT SPACING)
⊙	PIEZOMETER WELL LOCATIONS	➡	APPROXIMATE GROUNDWATER FLOW DIRECTION		
▢	BURIAL SITE AOC	―	STATION BOUNDARY	0 25 50	SCALE IN FEET

FIGURE 5.2

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BURIAL SITE
AOC SAMPLING PLAN
143rd CCSQ, Seattle ANGS
Seattle, Washington

OPTECH
OPERATIONAL TECHNOLOGIES CORPORATION

APRIL 1994

5.3.4 Proposed Piezometer Well Plan

Piezometer wells will be installed to identify the presence of groundwater contamination at the AOC. Three piezometer wells will be installed and sampled at this location. The proposed piezometer well locations for the Burial Site AOC are shown on Figure 5.2.

Soil and groundwater samples collected from upgradient piezometer well BS-004PZ will establish background conditions applicable to this AOC. The proposed depth of piezometer wells and the sampling program are shown in Table 5.1.

Groundwater samples will be obtained by methods outlined in Section 7.2. Groundwater samples will be analyzed for the parameters described in Section 7.0, Table 7.1. The provisions of the OpTech HSP and Appendix A will also apply throughout the sampling at this site.

Section 6

SECTION 6.0 FIELD SAMPLING PLAN

6.1 INVESTIGATIVE METHODS AND PROCEDURES

Mobilization involves the effort required by the contractor and subcontractors to prepare for field activities. A firm qualified to conduct a soil vapor survey in Washington will be retained for screening activities at the Seattle ANGS. A qualified drilling firm, licensed in the State of Washington, will be contracted for drilling boreholes and piezometers by hollow-stem auger. A qualified laboratory which follows an approved QA/QC program will be used for chemical analyses.

Field personnel will be provided with appropriate personal protective equipment, safety training, and field monitoring equipment. Field equipment will be inspected prior to mobilization and periodically calibrated to assure proper operation. Calibration procedures to be followed throughout this project are addressed in Appendix B.

Prior to any drilling activities, a review of all utilities including underground water and wastewater lines in the vicinity of the drilling site will be made. Any fees, permits or licenses required for drilling activities will be paid prior to the commencement of drilling (Section 4.0). In the event that any of the planned drilling locations are found to interfere with buried utilities or are located in an area subject to frequent flooding, the borings will be relocated as close as possible to the original location. Relocated drilling locations will be approved by the on-site geologist. The placement of drilling locations will be coordinated with Station personnel and personnel from the 241st CES, in order not to interfere with known underground utility locations or other underground obstructions. Once all activities have been completed at each specific drilling point, the location will be staked to facilitate subsequent surveying.

Following completion of all drilling activities, each site will be restored as closely as possible to its pre-site inspection condition. Demobilization will include decontamination of equipment used on the project and site cleanup. Well and boring sites will be inspected by the site manager to ensure that the sites are clean. Drilling equipment will be decontaminated, and all equipment and unused construction materials will be removed from the area.

Work at the AOC will begin at Level D protection with frequent monitoring to assure that Level D is appropriate. Protection Level C equipment and trained personnel will be available so that work can proceed at Level C, if required. All contractor and subcontractor personnel will adhere to the OpTech HSP requirements, and will be capable of working at Level C. All work will be performed in a manner consistent with State of Washington laws and regulations.

6.1.1 Geophysical Survey

A geophysical investigation technique (ground-penetrating radar) will be used in the site inspection at the AOC to detect the presence and location of buried structures.

Ground-penetrating radar is a shallow geophysical survey system that provides a continuous real-time cross section of shallow subsurface conditions. The technique is suitable for locating buried non-metallic targets or structures at depths of 3 to 30 feet BLS when the GPR device is operated at a frequency of approximately 500 MHz. A GPR system consists of a radar control unit, signal processing and conditioning circuitry, and a graphical recorder. The unit is connected by an electrical cable to a transducer. As the transducer (antenna) is towed along a traverse, it transmits radar impulses downward into the ground. At interfaces where changes in the electrical properties of the subsurface occur, the radar impulse typically undergoes an abrupt change in velocity, causing some of the radar energy to be reflected back to the antenna on the ground surface. The amount of energy that is reflected is dependent on the contrast of the respective radar velocity. The time it takes for the radar signal to travel from the antenna to a reflecting interface and back to the antenna is directly proportional to the depth of the interface. Recording these depth-dependent impulses on a scanning, time-based graphic chart recorder results in a cross-section depicting the longitudinal distribution of subsurface strata and other features over which the radar antenna has passed.

6.1.2 Soil Vapor Survey

Prior to installation of soil borings, a soil vapor survey will be conducted at the AOC as a screening tool for developing the optimum location of soil borings needed to confirm the absence or presence of soil contamination, as described in Section 5.3.2. The soil vapor survey will analyze for benzene, toluene, ethylbenzene, and xylenes (BTEX). Procedures to be followed in the conduct of the soil vapor survey are outlined in Appendix E.

6.1.3 Soil Boring Activities

The objectives of the drilling/boring program are: (1) to obtain soil samples to establish background levels applicable to the site; and (2) to obtain soil samples for analytical laboratory analysis and for defining any existing soil contamination. A total of three soil borings will be drilled at the AOC using hollow-stem auger methods (HSA).

6.1.3.1 Drilling Using Hollow-Stem Auger Methods

The HSA drilling method employs a hollow helical steel drill tool that is rotated to advance the boring and lift formation materials (cuttings) to the surface. The flights for the HSA are welded onto steel pipe and a cutter head is attached to the "lead" (bottom) auger to cut the hole. During drilling, a center bit is inserted into the hollow area of the cutter head that prevents cuttings from re-entering the hollow portion of the auger. Generally, the center bit is flush with or extends no more than 1/2 foot below the cutter head. The center bit connects through the auger flights by small diameter drill rods and is attached to the top-head drive unit of the drill rig. The top-head drive is powered by a truck-mounted engine that mechanically rotates the entire flight of augers. The hollow opening allows the insertion of sampling tools (i.e., split-spoon sampler) with the augers in place to prevent caving of the borehole.

6.1.3.2 Air Monitoring

During drilling operations, a photoionization detector (PID) will be used to monitor the breathing zone for organic vapors to determine the need for respiratory protection. A combustible gas indicator (CGI) will be used to monitor for explosive gases. Special actions will be required if explosive vapors reach 10 percent of the lower explosive limit (LEL) or if other specified action levels are reached, as outlined in the OpTech HSP and Appendix A.

6.1.3.3 Borehole Logging

An experienced geologist will be present at the operating drill rig or hand auger for logging the samples, monitoring drilling operations, recording soil data, and preparing the boring logs.

The lithologic record taken by the geologist during the drilling of each borehole will be based on visual inspection of soil samples supplemented by examination of drill cuttings. Material will be classified using the Unified Soil Classification System and described according to American Society of Testing and Materials (ASTM) D2488-90, "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)."

The following information will be logged for each boring:

- Boring identification number
- Name of driller and geologist
- Method of drilling
- Bit size
- Sampling method and depth
- Standard penetration test (SPT) blows
- GC and PID readings
- Hole location and elevation
- Depth of completed boring or well
- Weather conditions
- Date
- Reference elevations for all depth measurements
- Detailed soil descriptions, including soil moisture/saturation conditions
- Depth at which each distinct stratum is encountered
- Depth at which groundwater is first encountered while drilling
- Signatures of those performing this work
- Location of any fractures, joints, faults, cavities, or weathered zones identified

6.1.4 Piezometer Well Activities

Piezometer wells will be used to identify the presence of groundwater contamination, to obtain water level data for hydrogeologic characterization of the aquifer, and to obtain groundwater samples for laboratory analysis. A total of three piezometer wells are planned to be installed at the Seattle ANGS.

6.1.4.1 Piezometer Well Construction and Completion

Piezometer wells will be installed by a qualified well driller using HSA methods. Soil samples will be collected at each 5-foot interval for geologic classification and field screening for contaminants. Piezometer wells will be constructed in accordance with current Washington well construction standards.

Piezometer wells will be constructed of 2-inch ID, flush threaded, schedule 40 polyvinyl chloride (PVC) casing and screens meeting State of Washington well construction standards, and will have a bottom cap (see Figure 6.1). The screens will be constructed using a 2-inch continuous-slot PVC pipe with a PVC solid riser pipe. The top of the screen should be 2 feet above the top of the water table; however, in choosing the depth of the well screens, annual fluctuation of the water table will be taken into consideration. Screen slot size will be determined in the field. The well head will have a threaded, vented cap. A screen length of 15 feet is recommended to adequately account for annual groundwater level fluctuations. Historical records indicate annual groundwater level fluctuations to vary approximately 6 feet between wet

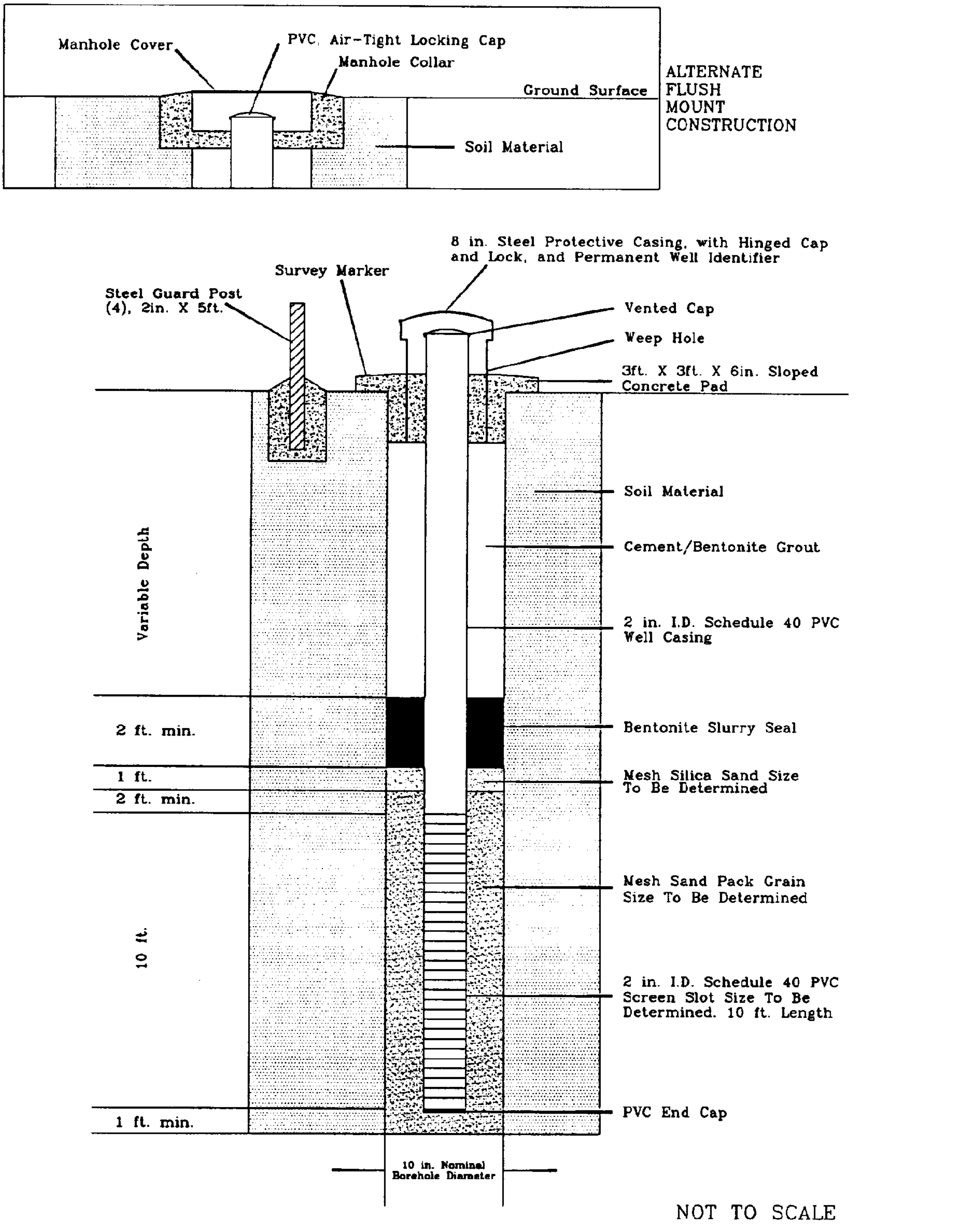

FIGURE 6.1	TYPICAL PIEZOMETER WELL CONSTRUCTION 143rd CCQS, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION
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and dry seasons. The well construction materials will be decontaminated before installation in the boreholes as outlined in Section 8.0.

In order for the Site Manager to determine if each piezometer well is aligned, a decontaminated section of pipe with a diameter of one-half inch less in diameter than the inner diameter of the well riser pipe, will be run through the entire length of the well. All risers will be set round, plumb, and true to line. Centralizers will be used, if necessary, to assure alignment of the wells. A well diagram will be prepared for each piezometer well installed and cross-sections depicting geological conditions will be prepared for each site.

The annulus around the casing will be filled with neat cement grout after the well is set in the borehole to prevent the flow of any contaminated water along the casing. The well annulus at the screen will be sand-packed from 2 feet below the bottom of the well screen to 2 feet above the top of the well screen by the tremie pipe method, using proper grain size, cleaned, washed and bagged silica sand. A 2-foot bentonite slurry seal, surface mixed and composed of a bentonite slurry, will be placed above the sand pack. The sand pack and screen size shall be designed such that the screen does not become plugged and that the water produced will be sand free. Sand pack and screen slot size will be determined in the field.

All wells will be completed either by finishing the casing approximately 2-1/2 feet above the top of the borehole (short sections of casing may be required) or by flush surface mount. The contractor will contact the 241st CES to determine whether a well will be completed with a flush mounting or be completed above ground. For above grade completion, a protective steel riser pipe equipped with a locking cap will be set in the neat concrete grout around the well casing to below frost depth. The well number will be permanently marked on the locking cap. The grout will be built up around the base of the riser pipe in a 3-foot square pad and will be sloped away to aid in runoff. All risers shall be provided with keyed-alike brass or stainless steel locks. The lock keys will be given to the Seattle ANGS on-site representative. The riser pipe will not be painted.

Three 4-inch-diameter steel guard posts filled with cement will be placed around the protective steel riser pipe of piezometer wells. All guard posts will be painted yellow to increase visibility. The bases for the guard posts will be set into concrete to a depth sufficient to prevent frost heave and will extend at least 4 feet above ground surface. Any well that is to be temporarily removed from service or left incomplete due to delays in construction will be capped with a watertight cap and equipped with a "vandal proof" cover.

Well construction where groundwater is less than 5 feet BLS will vary from normal wells. The top of the screen will be placed a maximum of 1 foot above the water table when the water table is less than 5 feet BLS. The top of the sand pack will either be placed 1 foot above the top of the screen or 2 feet from the land surface. A bentonite slurry seal will be placed above the sand pack. A bentonite/cement grout will be placed above the seal to the land surface. A protective steel riser pipe equipped with a locking cap will be set in the bentonite/cement grout, and will extend to a depth not to exceed the depth to the top of the well screen. The well will be finished at land surface with a 3-foot-square concrete pad that will be sloped to aid in runoff.

Wells completed by flush surface mount will be flush with the land surface (see Figure 6.1 inset). The casing will be cut 2 to 3 inches below land surface and installed with a protective locking lid consisting of a cast-iron valve box assembly. The valve box will be placed in the center of the hole with the top just above the ground surface. Concrete will be placed around the annular space and sloped away from the valve box to divert drainage. The well will also be fitted with a watertight compression casing cap to prevent infiltration of surface water. The well number will be clearly marked on the valve box lid and well casing. All well assemblies will be secured with keyed-alike brass or stainless steel locks. The lock keys will be given to the Seattle ANG on-site representatives.

Frost heave creates stability problems for wells constructed where the normal water table resides above the frost line. For these wells, a section of blank casing and cap will be added below the screen to aid in anchoring the well. This blank casing will be filled with clean sand and capped below the screen with 3-foot-thick bentonite slurry.

6.1.4.2 Piezometer Well Development

The wells will be developed between 24 and 48 hours of well installation and completion to allow sufficient time for the grout to set. All activities will be supervised by a geologist. The piezometer wells will be developed using a submersible electric pump without the use of any type of acids, dispersing agents or explosives. No water or other liquid will be introduced into the well during development other than formation water from that well. Care will be exercised to ensure that the screen is not damaged during development. Water from well development will be retained in 55-gallon drums, segregated by well, and labeled and stored as described in Section 8.0. After development, the wells shall stabilize a minimum of two days prior to sampling.

All the equipment used for the development of the piezometer wells will be decontaminated as referenced in Section 8.0. Once a well has been developed, a sample, approximately 1 liter of water from the well, will be collected in a clear glass jar. The jar will be properly labeled and photographed. The photograph will be a suitable back-lit close-up which shows the clarity of the water. The photograph will be submitted as part of the well log.

The water level in each well will be measured before development begins. Water levels will be measured using an electronic water level indicator accurate to 0.01 feet. This measuring device has a flat polypropylene tape with stainless steel wire in the tape to prevent it from stretching. The visual or audio signal is activated when water is encountered. The depth to water is measured from a prescribed point on the well casing. Piezometer well water depths will be reported to the nearest 0.01 foot. The water-level indicator and last 5 feet of tape will be decontaminated as referenced in Section 8.0 prior to lowering it into the wellbore.

During well development, stabilization and recovery testing will be conducted at each well point. For this testing, the specific conductance, pH, and temperature will be measured at intervals of one well volume until three successive readings yield equivalent values within the following ranges for each of the parameters:

- Specific Conductance (temperature corrected): $\pm$ 10 millimhos
- pH: $\pm$ 0.1 standard units
- Temperature: $\pm$ 0.5° C

The volume of water present in the well will be calculated as follows:

Volume of well in gallons: (0.0408) x (Well Diameter in inches)^2 x (Ft. of water column)

Well development will continue until the temperature, specific conductance and pH have stabilized and the groundwater removed is clear and free from sand. A record as to how much water was removed during the development of the well will be maintained. Physical and chemical parameters including temperature, pH, and specific conductance of the water will be measured during well development.

The temperature of the water will be measured using an electronic digital thermometer. This measurement will also be used to calibrate the pH and conductivity meter. The pH of the water will be measured using a portable pH meter. The meter will be calibrated daily using buffer solutions of the appropriate range of expected pH values. The meter will also be recalibrated periodically during periods of continued use as recommended by the manufacturer. The specific conductance of the water will be measured with a portable specific conductance meter. A standard potassium chloride solution will be used to calibrate the instrument daily. The meter will also be recalibrated periodically during periods of continued use as recommended by the manufacturer.

6.1.4.3 Recordkeeping During Well Development

The following information will be recorded in a field log for developing each piezometer well:

- Date;
- Well number and location;
- Reference elevations for all depth measurements;
- Depth at which groundwater is first encountered while drilling and 24 hours after completion;
- Depth of completed well;
- Depth and type of well casing;
- Depth to water table before development begins;
- Depth to top of the screen;
- Static water level upon completion of the well and after development;
- Pertinent construction details, such as description of gravel pack material;
- Purge method and rate;
- Documentation of pH and specific conductance meter calibration;
- Temperature, pH and specific conductance measured for the initial groundwater sample and for subsequent sampling;
- Signatures of those performing the work, and
- Photographs of sample(s).

6.2 FIELD SCREENING

6.2.1 Soil Samples

During subsurface soil sampling, the air surrounding the samples will be monitored with a PID immediately upon opening the sampler. All PID readings will be recorded in the field notebook. Information gained from this monitoring will be used to aid in the selection of a second sample from each boring for laboratory analysis.

Once the soil sample for laboratory analysis has been prepared, ambient temperature headspace analysis (ATHA) will be conducted for the remaining soil. The remaining soil will be placed in a sealed container, such as a clean, sealable plastic bag, for 15 minutes and allowed to reach ambient air temperature. After 15 minutes, a headspace reading will be collected using a PID.

A field gas chromatograph (GC), calibrated to screen for BTEX, will be used to analyze headspace from soil samples collected. Data obtained from the field GC will be used to aid in selecting an intermediate sample from each boring to be sent for laboratory analysis. Field GC data will be collected and submitted with the PA/SI report.

6.2.2 Groundwater Samples

Once the piezometer wells are developed and purged as outlined in Sections 6.1.4.2 and 7.2.2, groundwater samples will be collected for field screening and analytical analysis. During field screening, the specific conductance, pH, and temperature will be measured and recorded in the field notebook. Additionally, a groundwater sample will be collected from each piezometer for field GC analysis. A field GC, calibrated to screen for BTEX, will be used to analyze headspace from groundwater samples collected. Data obtained from the field GC will be used to provide initial groundwater quality data. Field GC data will be collected and submitted with the PA/SI report.

Section 7

SECTION 7.0 SAMPLE AND DATA COLLECTION PROCEDURES

Based on requirements of the SOW and the State of Washington, subsurface soil and groundwater samples will be analyzed for volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), priority pollutant metals, pesticides/polychlorinated biphenyls (PCBs), and total petroleum hydrocarbons (TPH) as described in Section 9.11.2 of the CEQP. The actual detection, reporting, and/or quantitation limits obtained for a specific sample depend upon the potential for matrix interferences. If the specified reporting limit is not achieved for a particular sample, an explanation of the problem and supporting evidence will be provided. Detection, reporting, and/or quantitation limit objectives for each analyte are included in the CEQP. Table 7.1 summarizes the planned laboratory analyses. Additional headspace analysis for soil and groundwater sample field screening using the field GC will be conducted for BTEX.

Table 7.1
Laboratory Analytical Program and Confirmation Activities Table
143rd CCSQ, Seattle ANGS, Seattle, Washington

AOC	Matrix	Field Methods	Lab Parameters	Methods	Investigative Samples
BS	Soil (Subsurface)	Field Screening using PID, Field GC, Soil Classification	VOC SVOC METALS PESTs/PCBs TPH Gross alpha and beta radiation	SW8240 SW8270 SW6010[a] SW8080 WTPH-HCID, WTPH-D SW9310	10
	Water (Subsurface)	Temperature, pH, Specific Conductance	VOC SVOC METALS PESTs/PCBs TPH Gross alpha and beta radiation	SW8240 SW8270 SW6010[a] SW8080 WTPH-D SW9310	3

[a]All metals analyzed by SW6010 except:

Arsenic – SW7060. Lead – SW7421. Thallium – SW7841.
Cadmium – SW7131. Mercury – SW7470.
Chromium – SW7196. Selenium – SW7740.

TPH – Total Petroleum Hydrocarbons.
SVOC – Semivolatile Organic Compounds.
VOC – Volatile Organic Compounds.
WTPH-HCID – Washington TPH (hydrocarbon identification).
WTPH-D – Washington TPH (diesel range).
BS – Burial Site.
PESTs – Pesticides.
PCBs – Polychlorinated biphenyls.
AOC — Area of Concern.
PID — Photoionization detector.
GC — Gas chromatograph.

7.1 SOIL

The purpose of subsurface soil sampling for laboratory analysis is to determine if soil contamination is present. Soil samples are to be taken areally and at different depths to aid in this definition. Specific sample collection procedures and protocols associated with the sampling, sample handling, shipment, and analysis are described in the CEQP.

Once the equipment decontamination procedures have been completed as specified in Section 8.0, soil sampling will be conducted in each borehole. Soil samples will be collected and field screened with field monitoring equipment, such as a PID, every 5 feet until the bottom of the boring is reached. Soil boring BS-003BH will be sampled continuously from surface to water table in order to determine the site geology and lithology. Soil sampling will be conducted with a high-carbon steel California-style sampler and standard sampling techniques to conform with ASTM D-1586. Soil samples for laboratory analysis will be collected with a California-style sampler with brass sleeves. The thin-wall brass sleeves will be used for soil samples in cohesive soils according to ASTM D-1587.

The California-style sampling technique to be used is the surface drop hammer system. This system utilizes an 18-inch to 24-inch long California-style sampler to collect soil samples. After the augers are advanced to a predetermined depth and the center bit attached to the drill rods is pulled out of the hole, the sampler will be lowered to the bottom of the hole. The sampler will first be seated 6 inches to penetrate any loose cuttings and then driven an additional one foot with blows of a 140-pound hammer falling 30 inches. Blow counts are measured every 6 inches to determine the physical characteristics of the material encountered. Fifty blow counts is considered formation refusal. If 50 blows are counted for a 6-inch interval, the sampler will be removed and the drill stem advanced through the material. The number of blows required to drive the sampler each of the three 6-inch increments will be recorded. The material encountered will be classified using the Unified Soil Classification System and described according to ASTM D2488-69, "Description of Soils (Visual Manual Procedures)."

When employing an 18-inch (or 24-inch) sampler, three (or four) 6-inch brass sleeves will be used to collect soil samples. The sleeve selected for analytical analysis will be the one with the most representative, cohesive, and undisturbed core of soil as determined by observation by the on-site geologist. In most situations, the sleeve at the bottom of the sampler best fulfills these requirements and is selected for analytical analysis. The sleeve at the top of the sampler will usually not be selected, because it is most likely to contain drill cuttings that were at the bottom of the borehole when the sampler was driven. Sufficient volume of soil will be recovered at each sampling interval to meet the analytical testing requirements outlined in the CEQP. In the event that an insufficient volume was obtained, an additional sample will be collected immediately beneath the unsuccessful sample interval.

Three soil samples will be collected and submitted for laboratory analysis from each soil boring location. One sample from immediately below the land surface and one sample from the bottom of the borehole will be collected and submitted for laboratory analysis. The third sample will be obtained from an intermediate interval where field screening indicates the highest level of contamination. Field GC and PID readings, as well as visual and olfactory methods, will be used to select the third sample for laboratory analysis.

7.2 GROUNDWATER

Piezometer wells will be used to identify the presence and extent of groundwater contamination, to determine background water conditions, to obtain water level data for hydrogeologic characterization of the aquifer, and to obtain groundwater samples for laboratory analysis. One round of groundwater samples will be collected from each of three piezometers at the Burial Site AOC.

7.2.1 Groundwater Level Data Collection

Groundwater level data will be collected as part of the field work. Two rounds of water level measurements will be made using an electronic water level indicator. The first round of water levels will be measured after each piezometer well is installed and prior to development. A second round of water levels will be measured immediately prior to sampling of the piezometer. Two rounds are necessary to insure that the water in each well has reached a static level. Given the duration of the site inspection, a period of no more than five days is anticipated between water level measurement rounds. A water table map will be prepared from the data collected.

7.2.2 Well Purging Procedures

Each piezometer well will be purged immediately prior to sample collection. Well purging equipment will be positioned so that any potential volatile organic sources, such as vehicles or air compressors are downwind of the well. This will preclude contamination caused by entrainment of volatile contaminants in the sample from these sources.

Wells will be purged with a bailer. The bailer will be positioned near the middle of the screened interval of the well to ensure that standing water is removed and fresh formation water is drawn into the well. When purging a well with a bailer, purging is considered complete when the indicator parameters of pH, temperature, conductivity, and color have stabilized, and three well volumes of water have been removed from the well. Wells that recharge extremely slowly will be purged dry, allowed to recharge, and then be purged again. The amount of fluid purged will be measured and recorded.

A 5-gallon bucket will be used to measure the amount of water being removed from the well during the purging process. Purged water will be collected in 55-gallon drums, segregated by well. Proper management and disposal of water will be determined after subsequent sampling has been completed and laboratory analysis results obtained.

7.2.3 Groundwater Sampling

Groundwater samples for laboratory analysis will be collected from each new piezometer well installed during this investigation. The laboratory analysis data will be used to determine if groundwater contamination is present and, if present, to aid in defining the horizontal extent of groundwater contamination in the source areas.

One round of groundwater sampling will be done. The sampling round will consist of sampling and analysis of groundwater from the wells installed during this investigation. All groundwater sampling will be completed as soon as possible after well installation is completed, but each well will be allowed to stabilize a minimum of two days after development and prior to sampling.

Immediately prior to collecting a sample, the static water level below the top of the casing in the well will be measured and recorded in the field notebook. Whenever feasible, wells expected to be uncontaminated will be sampled first, followed by wells with increasing levels of expected contamination. Wells will be sampled using teflon bailers and monofilament line (a new line will be used for each well). Each bailer will be decontaminated between wells. The bailer will be rinsed once with well water (first bail is discarded) prior to collecting a sample. All sampling equipment will be kept off soil to prevent cross-contamination of the samples (e.g., equipment will be placed on polyethylene plastic sheeting).

7.2.4 Regional Hydrogeologic Characteristics

Documented regional hydrogeologic characteristics will be collected to define the occurrence and movement of groundwater flow in the area around the station. This characterization will be based upon published information.

7.3 LAND SURVEYING

All new borehole and well installations will be surveyed by a state-licensed surveyor to define their locations and elevations for future reference. All new well installations shall be referenced both horizontally and vertically. The top of the well casing will be surveyed off a permanent marker (e.g., manhole cover, fire hydrant, bridge abutment, etc.), and measured to the nearest $\pm$0.01 foot. A permanent benchmark will be established near the site and will be tied to MSL datum. All positions and coordinates of all permanent points within the control traverse shall be shown. Horizontal control will be established to the nearest foot. Boreholes will be located within $\pm$1.0 foot horizontally and $\pm$0.1 foot vertically.

7.4 FIELD DOCUMENTATION PROCEDURES

7.4.1 Photographs

Field activities will be documented with photographs. Photographs will be taken of activities at the study site showing borehole drilling, soil sampling, and the installation of piezometer wells. Photographs will also be taken to show groundwater sampling procedures and to document decontamination of drilling equipment. One copy of annotated photographs will be provided to the ANGRC.

7.4.2 Field Logs

All data collection activities performed at a site will be documented using waterproof, indelible black ink, in a field notebook or on the chain-of-custody forms. Field notebooks will be bound, waterproof books, and will be assigned to individual field personnel for use during the duration of their field activities. Entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance solely on the sampler's memory. All field activities will be dated and signed by the person making the entries.

The Site Manager will maintain a separate Site Log which will summarize daily field activities, outside visitors, communications, sample shipments, and equipment assignments. This log will become a part of permanent project files. A copy of the field logs shall be made available to ANGRC.

If an incorrect entry is made in any type of data document, the incorrect data will be lined out with a single line, the correct information entered in indelible black ink, and the correction initialed and dated by the person making the correction.

Each analytical instrument is assigned a specific instrument logbook. All maintenance activities are recorded in the instrument log. The information entered in the instrument log includes:

- Date of service;
- Person performing service;
- Type of service performed and reason for service;
- Replacement parts installed (if appropriate); and
- Other information as required.

7.4.3 Variance and Auxiliary Logs

To maintain a record of sample collection, transfer between sample custodians, shipment, and receipt by the laboratory, a chain-of-custody record will be filled out for each sample at each sampling location. Each time the samples are transferred, the signature of the person relinquishing and receiving the samples, as well as the date and time of transfer, will be documented. A sample chain-of-custody is shown in Figure 7.1.

Page ____ of ____ Pages

CHAIN-OF-CUSTODY AND LAB REQUEST WORK FORM

Project Number:	Client/Project Name:	Project Location:

Field Sample No./ Identification	Date and Time	Grab	Composite	Sample Container (Size/Material)	Sample Type (Liquid, Sludge, Etc.)	Preservative	PCM	TEM	PLM	TPH	BTEX	TCLP	LEAD	BENZENE	PCB	TOX	VOC	OTHER	Laboratory Remarks

Samplers: *(Signature)*	Relinquished By: *(Signature)*	Date: Time:	Received By: *(Signature)*	Date: Time:	Intact:
	Relinquished By: *(Signature)*	Date: Time:	Received By: *(Signature)*	Date: Time:	Intact:
OpTech Point of Contact:	Relinquished By: *(Signature)*	Date: Time:	Received By: *(Signature)*	Date: Time:	Intact:
SAMPLER REMARKS: Container Seal No.:			Received for Laboratory: *(Signature)* Data Results To:	Date: Time:	Laboratory No.

September 1991

FIGURE 7.1 M\SEATTLE\SEA-COC	SAMPLE CHAIN-OF-CUSTODY FORM (REDUCED) 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

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The initial responsibility for monitoring the quality of field measurements and observations lies with field personnel. The Site Manager is responsible for verifying that all quality control procedures are being followed. This requires that the Site Manager assess the correctness of field methods and the ability to meet quality assurance objectives. If a problem occurs that might jeopardize the integrity of the project or cause some specific quality assurance objective not to be met, it is the responsibility of all field project staff to report all suspected nonconformances by initiating a nonconformance report and submitting it to the Project Manager.

The Project Manager will submit a copy of the nonconformance report to the QA/QC Manager for formal investigation. An appropriate corrective action will then be decided upon and implemented. The Project Manager will document the problem, the corrective action, and the results, using the form shown in Figure 7.2. Copies of the documentation form will be provided to the Site Manager and the QA/QC Manager.

7.5 SAMPLE HANDLING PROCEDURES

7.5.1 Sample Containers

All soil samples submitted for laboratory analysis collected with a California-style split-spoon sampler will be contained in brass sleeves. Immediately upon removal from the sampler, the sleeve ends will be covered with a Teflon barrier, aluminum foil, and fitted with a plastic cap. The plastic caps will then be secured with duct tape. The sleeves will then be properly labeled, placed in plastic bags, stored in coolers, and chilled to 4° C or less.

SVOC water samples will be stored in 1-liter amber glass bottles having teflon-lined lids. Total recoverable metal water samples will be stored in a 1-liter high density polyethylene bottle with a teflon-lined lid. Water samples gathered for pesticides/PCBs will be stored in a 1-liter amber glass bottle with a teflon-lined lid. Water samples gathered for Washington TPH (WTPH) will be stored in a 1-liter amber glass bottle with a teflon-lined lid. Samples gathered for alpha and beta will be stored in 2-liter high-density polyethylene (HDPE) containers. VOC water samples will be stored in 40-milliliter (mL) volatile organic analysis (VOA) vials with a teflon-lined lid and no airspace. The samples will be immediately placed on ice to reduce their temperature to 4° C or less.

CORRECTIVE ACTION DOCUMENTATION

Report No._______ Page___ of___

DATE/ORIGINATOR:____________________________

PERSON RESPONSIBLE FOR
RESPONSE:____________________________

DESCRIPTION OF PROBLEM AND WHEN
IDENTIFIED:____________________________

STATE CAUSE OF PROBLEM IF KNOWN OR
SUSPECTED:____________________________

SEQUENCE OF CORRECTIVE ACTION (If no responsible person is identified,bring this form directly to the Manager of Quality Assurance):

State Date, Person, and Action
Planned:____________________________

Corrective Action Approved By:__________________
Date:________________________
Followup Dates:____ ____ ____ ____ ____

Description of
Followup:____________________________

Final Corrective Action Approved By:__________________
Date:________________________

Other
Information:____________________________

FIGURE 7.2 K\SEATTLE\SEA-CAF	CORRECTIVE ACTION FORM (REDUCED) 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

7.5.2 Sample Preservation and Packaging

Holding times for samples, shown in Figure 4.1 of the CEQP, list the maximum times that samples may be held before the completion of analytical protocols. All samples will be chilled to 4°C or less and maintained at or below that temperature during transport and subsequent storage at the analytical laboratory. In no case will samples be retained on-site over 24 hours.

Water samples submitted for laboratory analysis require preservation. VOC samples will be preserved with no more than 2 drops of a 1:1 solution of hydrochloric acid per 40-mL VOA vial. VOC samples will be stored inverted in the ice chest. Total recoverable metal samples will be preserved with a solution of 1:1 nitric acid to achieve a pH level of less than 2. WTPH samples will be preserved with a solution of 1:1 sulfuric acid to achieve a pH of less than 2. Gross alpha and beta samples will be preserved with a solution of 1:1 nitric acid. SVOC and pesticide/PCB samples require no preservatives.

All sample containers will be packed in an ice cooler with appropriate packaging to prevent breakage of containers during shipment. The packaging will be complete when the samples are packed in the cooler. Custody seals, signed and dated by a member of the field team, will be placed over the lid edge. The cooler will be completely sealed with fiber tape.

7.5.3 Sample Identification

All samples will be identified with a label attached directly to the container. Sample label information will be completed using waterproof black ink and will contain the following information:

- Sample number;
- Time and date of collection;
- Installation name;
- Parameters to be analyzed;
- Preservative (if any);
- Sample source/location; and
- Sampler's initials.

7.5.4 Sample Custody and Transport

The chain-of-custody will be filled out at the time the samples are packed for shipment. Prior to the shipment of samples, the chain-of-custody record will be signed and dated by a member

of the field team who has verified that those samples indicated on the chain-of-custody record are indeed being shipped.

All samples will be shipped by courier, such as Federal Express, or hand delivered by contractor personnel to the analytical laboratory. Samples will be transported, each day, by field personnel from the Station to the courier location for subsequent shipment to the laboratory. Upon receipt of the samples at the laboratory, the receiver will complete the transfer by dating and signing the chain-of-custody record. An acceptable alternative is to enter the airbill number and shipping data into the appropriate signature/date block. A copy of the airbill is to be kept with the field copy of the chain-of-custody form to reflect specific shipping information.

Upon receipt, the sample custodian will inspect containers for integrity. The presence of leaking or broken containers will be noted on the chain-of-custody record. The sample custodiam will sign the chain-of-custody record with the date and time of receipt, thus assuming custody of the samples. The information on the chain-of-custody record will be compared with the information on the sample tags and labels to verify exact sample identity. Any inconsistencies will be immediately resolved with the field sampling representative before sample analysis proceeds.

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Section 8

8.0 EQUIPMENT DECONTAMINATION PROCEDURES

In order to prevent cross-contamination, all nondedicated sampling equipment (i.e., brass sleeves, end caps, split-spoon samplers, bailers, etc.) will be decontaminated prior to use and between samples using the following procedures. Sampling equipment will be washed using a brush and laboratory-grade detergent (Alconox or Liquinox), followed by a rinse with drinking-quality water, an ASTM Type II reagent water, and pesticide-grade methanol. Decontaminated sampling equipment will be allowed to air dry and will be wrapped in a non-plastic material (usually aluminum foil). Wrapped equipment will be stored in such a manner as to reduce the potential for accidental contamination.

Testing and monitoring equipment (probes, thermometers, etc.) that come in contact with soil or groundwater samples will be decontaminated by being rinsed with an ASTM Type II reagent water, and pesticide-grade methanol. They will then be allowed to dry completely before being used. This decontamination procedure will be followed immediately after each use of the equipment.

Drilling and testing equipment (drill rig equipment, augers, PVC pipe) will be decontaminated prior to use and between borehole/piezometer well installation. Equipment will be moved to a site-specific decontamination area where the equipment will be thoroughly steam-cleaned. Likewise, all casing and screens installed in piezometer wells will be thoroughly steam-cleaned before placement within the wellbore. The decontamination area will be located near site activities to reduce the potential spread of contamination, and located upwind to reduce the chance of airborne contamination. Liquid from decontamination activities will be collected and drummed, and handled as inspection-derived waste as outlined in Section 10.0.

Line used to lower aqueous sampling equipment into the well will be used only for the well being sampled. In no case will the line be reused.

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Section 9

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SECTION 9.0 BOREHOLE ABANDONMENT PROCEDURES

All borehole abandonment activities will conform to Washington State requirements, including sealing material and placement methods for boring abandonment. All borings will be cement grouted from the bottom of the borehole to the surface using a tremie pipe. The cement grout shall consist of a mixture of portland cement, ASTM C-150, and water in the proportion of not more than seven gallons of clean water per bag of cement (one cubic foot or 94 pounds). Additionally, a 3 percent by weight volume of bentonite powder will be added to the mixture. Borings will be backfilled with grout immediately after the sampling has been accomplished to prevent downward migration of contaminants through the open borehole.

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Section 10

SECTION 10.0 SITE INSPECTION-DERIVED WASTE HANDLING PROCEDURES

During the SI, a certain amount of site-specific and miscellaneous (disposable personal protective equipment, disposable sampling equipment, etc.) waste material will be produced as a result of site inspection activities. The contractor will be responsible for sampling, characterizing, drumming, labeling, preparing necessary manifests, and recommending appropriate and applicable methods of disposal or treatment for wastes (determined to be hazardous) generated during this project within 60 days of completing the field work. Once the waste is drummed, the drums will be properly marked as to their contents, collection dates, contractor name, phone number, and borehole or piezometer well ID numbers. The Seattle ANGS is responsible for the final disposal of the wastes generated during the project.

10.1 SOURCE AND STORAGE OF WASTES

Drill cuttings will be produced during the installation of soil borings and pieometer wells. These will be preliminarily characterized by monitoring for organic vapor emissions with a PID or screening with a field GC. All soil cuttings from each drilling location will be drummed in steel, plastic-lined 55-gallon drums at the time of drilling. Proper management and disposal of cuttings will be determined after subsequent sampling has been completed and laboratory analysis results obtained. If high concentrations of analytes are detected in the samples analyzed, the Toxicity Characteristic Leaching Procedure (TCLP USEPA SW-846 Method 1311) will be performed on the appropriate drill cuttings to aid in determining the hazardous waste classification.

10.2 RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) GUIDELINES

Materials excavated or removed from the site will be regulated as hazardous waste if they meet the definition provided in Title 40, Code of Federal Regulation, Chapter 261, (40 CFR 261).

SI activities involving the movement or removal of hazardous waste will comply with RCRA hazardous waste generator requirements provided in 40 CFR 262 and 40 CFR 263.

The Land Disposal Restrictions (also known as Land Ban Requirements) potentially affect the disposal of hazardous wastes generated during the SI. RCRA waste disposal requirements are set forth in 40 CFR 268. However, wastes treated in accordance with treatment standards or that meet concentration-based criteria provided in 40 CFR 268 Subpart D may be land-disposed as provided therein.

If any waste derived from the site inspection is determined to be hazardous wastes as defined in 40 CFR 261.3, storage or disposal of that waste must be in accordance with 40 CFR 264 for permitted facilities or 40 CFR 265 for interim status facilities.

10.3 HAZARDOUS MATERIALS TRANSPORTATION ACT

If hazardous wastes are transported off-site, U.S. Department of Transportation (DOT) hazardous material transportation requirements in 49 CFR 171-179, pursuant to the Federal Hazardous Materials Transportation Act, may be applicable. These requirements are supplemental to RCRA transporter requirements in 40 CFR 263.

10.4 STATE REQUIREMENTS

The State of Washington regulates solid and hazardous waste management through the rules of the Department of Ecology. The Washington Dangerous Waste Regulations implement Chapter 70.105 Revised Code of Washington (RCW), the Hazardous Waste Management Act of 1976, as amended in 1980 and 1983, and implements in part, Chapter 70.105A RCW, and Subtitle C of Public Law 94-580, The Resource Conservation and Recovery Act. The rules are codified in the Washington Administrative Code (WAC), Title 173, Chapters 173-303-010 through 173-303-9907, as amended March 7, 1991. This regulation designates those solid wastes which are dangerous or extremely hazardous to the public health and the environment. These rules govern dangerous waste identification, generation, transportation, and treatment, storage or disposal (TSD) facilities.

The procedures for determining whether or not a solid waste is a dangerous waste or extremely hazardous waste is described in WAC 173-303-070 through 103. The requirements for generators of dangerous waste are included in WAC 173-303-170 through 230. WAC 173-303-240 through 270 apply to transporters of hazardous waste.

Section 11

SECTION 11.0 SUMMARY OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

During any environmental investigation, a variety of Federal, State, and local regulations or requirements may govern specific actions. This section provides a brief summary of potential ARARs that have been identified.

11.1 INTRODUCTION

Generally, ARARs are used in determining the appropriate extent of site cleanup, developing site-specific remedial response directives, formulating remedial action alternatives, and directing site cleanup under the selected actions. ARARs not only guide the selection and evaluation of remedial alternatives during the feasibility study (FS), but also provide guidelines for field programs of an SI or remedial investigation (RI). During the SI, preliminary ARARs help focus field activities that provide data needed for the RI/FS and remedial design (RD) and also provide guidance for conducting fieldwork in an environmentally sound manner. ARARs are reevaluated and either refined or expanded as fieldwork progresses and as more information about a particular site is collected.

As described in the National Oil and Hazardous Substance Pollution Contingency Plan (NCP), ARARs are categorized into three groups. Location-specific ARARs pertain to existing natural features (e.g., wetlands, streams, floodplains, and sensitive ecosystems) and man-made site features (e.g., existing landfills, disposal areas, and places of historic or archaeological significance). Chemical-specific ARARs are usually health- or risk-based standards that limit the concentration of a chemical found in or discharged to the environment. Site-specific ARARs are usually technology- or activity-based limitations that control actions at hazardous waste sites and thereby pertain to proposed site remedies.

11.2 SUMMARY OF POTENTIAL ARARs

Section 121(d) of CERCLA, as amended by SARA of 1986, addresses the management of Federal facilities. The IRP has been designed to mirror site inspection requirements under CERCLA. Federal RCRA regulations governing hazardous waste management provide both action- and chemical-specific ARARs that may apply to PA/SI activities.

Federal regulations pursuant to the Safe Drinking Water Act (SDWA) govern the quality, usage, and discharge of groundwater used as a public supply. Maximum contaminant levels (MCLs) specified in 40 CFR 141.11-141.16 are legally enforceable Federal drinking water standards established by the USEPA. Maximum contaminant level goals (MCLGs) specified in 40 CFR 141.50-141.51 are nonenforceable, health-based goals for drinking water.

The Federal Clean Water Act (CWA) and pursuant regulations provide potential location, chemical, and action-specific ARARs for IRP activities at the Station. The USEPA has promulgated Ambient Water Quality Criteria (AWQC) for surface and groundwater through 40 CFR 131. Aligned with the Federal Clean Water Act criteria, the standard governing AWQC presents scientific data and guidance on the environmental effects of pollutants, rather than only establishing regulatory requirements. As a general statement, AWQC are applied when evaluating cleanup levels for groundwater.

National Pollutant Discharge Elimination System (NPDES) regulations govern discharges to surface water and control surface water runoff from Station stormwater discharge systems. Promulgation of CWA Section 402 and formal ARARs are established for NPDES through 40 CFR 122 and 40 CFR 125, and provide action- and chemical-specific ARARs.

All site operations are governed by Occupational Safety and Health Act (OSHA) standards of health and safety under 29 CFR 1910. Other applicable OSHA ARARs include health and safety for Federal service contracts (29 CFR 1926) and recordkeeping and reporting under 29 CFR 1904.

If material containing hazardous wastes are to be transported off-site, U.S. DOT hazardous material transportation requirements in 49 CFR 171-179, pursuant to the Federal Hazardous Materials Transportation Act, may be action-specific ARARs for SI activities. These requirements are supplemental to RCRA transporter requirements in 40 CFR 263.

The Federal Clean Air Act (CAA) may provide action- and chemical-specific ARARs for IRP activities, including subsequent field investigations and remedial actions, which may include soil excavation or incineration. All remediation activities must comply with National Primary and Secondary Ambient Air Quality Standards (NAAQS) found in 40 CFR 50. Rules governing particulate matter less than 10 microns in size (PM_{10}) are contained in 40 CFR 50, and are important from the potential detrimental effects of such particles on the lungs.

If PCBs are detected during SI sampling activities, or their potential presence is indicated by historical data, the USEPA regulations (40 CFR 761) pursuant to the Federal Toxic Substance Control Act (TSCA) could become chemical- and action-specific ARARs. These rules apply to the manufacture, marking, storage, disposal, spill cleanup, and recordkeeping and reporting of PCBs and PCB-contaminated materials. The PCBs spill cleanup policy (40 CFR 761 Subpart G) sets forth cleanup standards for spills of PCBs greater than 50 ppm that have occurred after May 7, 1987.

11.3 FEDERAL GUIDANCE TO BE CONSIDERED

In addition to Federal and State requirements that may be applicable or relevant and appropriate to IRP activities, Federal nonregulatory criteria must be considered. These chemical-specific criteria, used to help characterize risks and to set cleanup goals, include the following:

- USEPA Risk Reference Doses
- USEPA Health Advisories
- USEPA Carcinogen Assessment Group Potency Factors
- USEPA Acceptable Intake Values, Chronic and Subchronic
- USEPA guidance manual on water-related fate of 129 priority pollutants (USEPA, 1979)

11.4 STATE REQUIREMENTS

In addition to federal ARARs, several Washington State regulations may be applicable or relevant and appropriate to SI activities and potential remedial alternatives at the installation.

11.4.1 Washington Hazardous Waste Cleanup Regulations

Washington Hazardous Waste Cleanup Regulations, promulgated under the Model Toxics Control Act, as amended January 25 1991, establishes administrative processes and standards to identify, investigate, and clean up facilities where hazardous substances have come to be located. The Act is codified in WAC, Title 173, Chapter 173-340. This chapter is primarily intended to address releases of hazardous substances caused by past activities although its provisions may be applied to potential and ongoing releases of hazardous substances from current activities. "Hazardous substance" means any dangerous or extremely hazardous waste as defined in RCW 70.105.010 (5) and (6), or any dangerous or extremely dangerous waste as designated by rule under Chapter 70.105 RCW; any hazardous substance as defined in RCW

70.105.101 (14) or any hazardous substance as defined by rule under Chapter 70.105 RCW; any substance that, on the effective date of this section, is a hazardous substance under section 101 (14) of the federal cleanup law, 42 U.S.C., Section 9601 (14); petroleum or petroleum products; and any substance or category of substances, including soil waste decomposition products determined by the director by rule to present a threat to human health or the environment if released into the environment.

An overview of cleanup standards is provided in WAC 173-340-700. These cleanup standards are potential chemical- or action-specific ARARs for SI projects. There are three basic methods for establishing cleanup levels. Method A tables have been developed to provide conservative cleanup levels for sites undergoing routine cleanup actions or those sites with relatively few hazardous substances. Method A cleanup levels for groundwater and soil are presented in Tables 11.1 and 11.2, respectively. Exceedances of the values in these tables do not necessarily trigger requirements for cleanup action under this chapter. Under Method A, cleanup levels for hazardous substances are established at concentrations at least as stringent as concentrations specified in applicable state and federal laws. Cleanup levels for hazardous substances not addressed under applicable state and federal law or in Tables 11.1 and 11.2, are established at concentrations which do not exceed the natural background concentration or the practical quantitation limit for the substance in question.

Table 11.1
Method A Cleanup Levels for Groundwater
143rd CCSQ, Seattle ANGS, Seattle, Washington

Hazardous Substance	CAS Number	Cleanup Level (ug/L)
Arsenic	7440-38-2	5.0
Benzene	71-43-2	5.0
Cadmium	7440-43-9	5.0
Chromium (total)	7440-47-3	50.0
DDT	50-29-3	0.1
1,2-Dichloroethane	107-06-2	5.0
Ethylbenzene	100-41-4	30.0
Ethylene dibromide	106-93-4	0.01
Lead	7439-92-1	5.0
Lindane	58-89-9	0.2
Methylene chloride	75-09-2	5.0
Mercury	7439-97-6	2.0
PAHs (carcinogenic)	-	0.1
PCB mixtures	-	0.1
Tetrachloroethylene	127-18-4	5.0
Toluene	108-88-3	40.0
TPH	-	1,000.0
1,1,1 Trichloroethane	71-55-6	200.0
Trichloroethylene	79-01-5	5.0
Vinyl chloride	75-01-4	0.2
Xylenes	1330-20-7	20.0

CAS - Chemical Abstract Service
DDT — 1,1,1 Trichloro-2,2-bis (p-chlorophenyl)-ethane
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyl
TPH - Total petroleum hydrocarbons
ug/L - micrograms per liter

Source: Washington Hazardous Waste Cleanup Regulations WAC 173-340-720.

Table 11.2
Method A Cleanup Levels for Soil
143rd CCSQ, Seattle ANGS, Seattle, Washington

Hazardous Substance	CAS Number	Cleanup Level (mg/Kg)
Arsenic	7440-38-2	20.0
Benzene	71-43-2	0.5
Cadmium	7440-43-9	2.0
Chromium	7440-47-3	100.0
DDT	50-29-3	1.0
Ethylbenzene	100-41-4	20.0
Ethylene dibromide	106-93-4	0.001
Lead	7439-92-1	250.0
Lindane	58-89-9	1.0
Methylene chloride	75-09-2	0.5
Mercury (inorganic)	7439-97-6	1.0
PAHs (carcinogenic)	-	1.0
PCB mixtures	-	1.0
Tetrachloroethylene	127-18-4	0.5
Toluene	108-88-3	40.0
TPH (gasoline)	-	100.0
TPH (diesel)	-	200.0
TPH (other)	-	200.0
1,1,1 Trichloroethane	71-55-6	20.0
Trichloroethylene	79-01-5	0.5
Xylenes	1330-20-7	20.0

CAS - Chemical Abstract Service
DDT — 1,1,1 Trichloro-2,2-bis (p-chlorophenyl)-ethane
PAH - Polycyclic aromatic hydrocarbon
PCB - Polychlorinated biphenyl
TPH - Total petroleum hydrocarbons
mg/Kg - milligram per kilogram

Source: Washington Hazardous Waste Cleanup Regulations WAC 173-340-740.

11.4.2 Washington Dangerous Waste Regulations

The State of Washington regulates solid and hazardous waste management through the rules of the Department of Ecology. The Washington Dangerous Waste Regulations implement Chapter 70.105 RCW, the Hazardous Waste Management Act of 1976, as amended in 1980 and 1983, and implements in part, Chapter 70.105A RCW, and Subtitle C of Public Law 94-580, The Resource Conservation and Recovery Act. The rules are codified in WAC, Title 173, Chapter

173-303-010 through 173-303-9907, as amended March 7, 1991. This regulation designates those solid wastes which are dangerous or extremely hazardous to the public health and environment. These rules govern dangerous waste identification, generation, transportation, and treatment, storage, or disposal (TSD) facilities.

11.4.3 Washington Drinking Water Regulations

Washington Drinking Water Regulations define basic regulatory requirements which protect the health of consumers using public drinking water supplies. The rules are codified in WAC, Title 246, Chapter 290, as amended April 15 1991. These regulations may be considered potential chemical- or action- specific ARARs for SI projects in the State.

11.5 SITE-SPECIFIC ARARs

Based on the initial understanding of the environmental situation at the AOC at Seattle ANGS, Table 11.3 identifies potential chemical- and location-specific ARARs. Because of the potential for impact to both surface and groundwater, some of these ARARs will influence assessment of the SI hydrogeological sampling, and analysis results by requiring consideration of drinking water standards. These ARARs will be reviewed and updated as site data are confirmed and quantified.

Table 11.3
Potential Chemical- and Location-Specific Applicable or Relevant and Appropriate Requirements
143rd CCSQ, Seattle ANGS, Seattle, Washington

Media	Potential Federal ARARS	Potential State ARARs	Other Requirements to be Considered
Groundwater	* RCRA Subpart F Groundwater Protection Standards, Alternate Concentration Limits ** Safe Drinking Water Act - Maximum Contaminant Levels (40 CFR 141.11-141.16)	* Washington Model Toxics Control Act * Washington Hazardous Waste Cleanup Regulations ** Washington Drinking Water Regulations	Safe Drinking Water Act - Maximum Contaminant Level Goals Clean Water Act - Ambient Water Quality Criteria Health Advisories (USEPA Office of Drinking Water) USEPA Risk Reference Doses USEPA Carcinogen Assessment Group Potency Factors Acceptable Intake - Chronic and Subchronic USEPA Health Assessment Documents USEPA Office of Water Guidance - Water-related Fate of 129 Priority Pollutants (1979)
Soils/Sediment/Waste	** Land Disposal Restrictions for Hazardous Waste (40 CFR Part 268) * Toxic Substance Control Act - PCBs Disposal Requirements (40 CFR Part 761)	* Washington Model Toxics Control Act * Washington Hazardous Waste Cleanup Regulations * Washington Dangerous Waste Regulations	None Identified

*	=	Applicable
**	=	Relevant and Appropriate
RCRA	=	Resource Conservation and Recovery Act
USEPA	=	U.S. Environmental Protection Agency
PCBs	=	Polychlorinated biphenyls

Section 12

SECTION 12.0 PROJECT SCHEDULE FOR PA/SI

Figure 12.1 presents the project timeline for accomplishing the required PA/SI and Management Action Plan (MAP) at Seattle ANGS, Seattle, Washington. As shown, the total project time spans that time period from the start of the PA/SI site inspection to the final PA/SI report and MAP submission. The total time of the project is projected to be 36 weeks. Of this, it is estimated that 2 weeks will be required to conduct the SI and 15 weeks to complete the draft PA/SI report. The MAP is optional and will only be completed if the AOC is converted to an IRP site based on contamination found during the PA/SI. If required, preparation of the MAP will commence at the time of receipt of the draft PA/SI report comments from ANGRC. The schedule status will be reported on a monthly basis, with any deviations noted and explained. Significant events which affect the schedule will be reported out-of-cycle if necessary to insure necessary management action is implemented in a timely fashion.

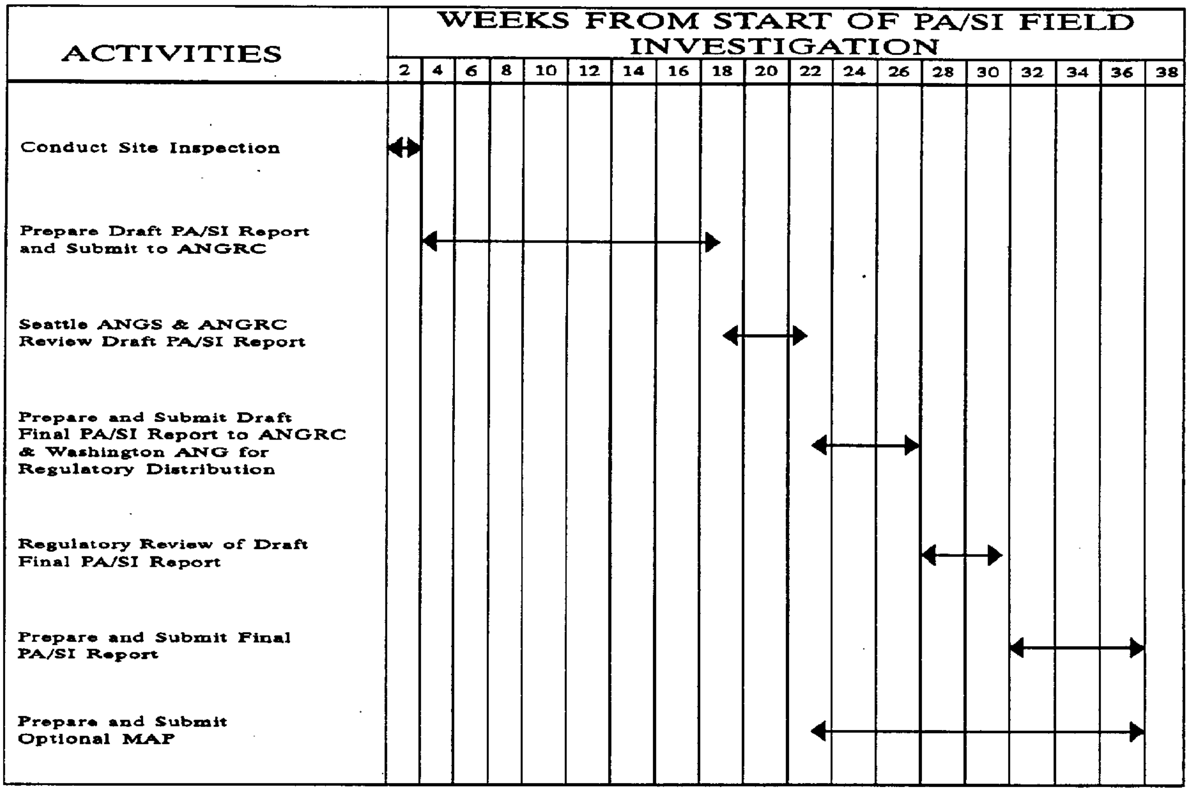

Figure 12.1

SEA13-1P

SEATTLE ANGS PA/SI SCHEDULE
143rd CCSQ, Seattle ANGS
Seattle, Washington

OPTECH
OPERATIONAL TECHNOLOGIES

It should also be noted that for the large activity in Figure 12.1 entitled "Prepare Draft PA/SI Report and Submit to ANGRC," a lower level work breakdown structure will be utilized to control specific project activity. Microsoft Project software will be used for this purpose.

Information required for the HRS will be gathered and provided in the Draft PA/SI Report (see Appendix C). Also, the DPM scoring will be completed at the same time. These two activities will be accomplished only under the condition that the laboratory analytical data indicate that the Burial Site AOC will require further investigation.

Section 13

SECTION 13.0 PA/SI REPORT

13.1 PA/SI REPORT PURPOSE

The PA/SI Final Report will detail the activities and findings of the PA, and data and analytical results obtained from the site inspection to support a no further action decision document, or identification of the areas of concern requiring immediate clean-up/remedial activities or further investigation in the form of an RI/FS.

13.2 PA/SI REPORT FORMAT

The proposed PA/SI Final Report will consist of an executive summary, eight sections, references, and supporting appendices. The annotated PA/SI Final Report format is listed below:

Table of Contents
List of Figures
List of Tables
List of Acronyms

EXECUTIVE SUMMARY

1.0 INTRODUCTION
- **1.1 BACKGROUND**
- **1.2 PURPOSE**
- **1.3 SCOPE**
- **1.4 METHODOLOGY**

2.0 INSTALLATION DESCRIPTION
- **2.1 LOCATION**
- **2.2 ORGANIZATION AND HISTORY**

3.0 ENVIRONMENTAL SETTING
- **3.1 METEOROLOGY**
- **3.2 GEOLOGY**
- **3.3 HYDROLOGY (LOCAL AND REGIONAL)**
- **3.4 CRITICAL HABITATS/ENDANGERED OR THREATENED SPECIES**

4.0 SITE EVALUATION
- **4.1 ACTIVITY REVIEW**
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SECTION 14.0 REFERENCES

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Appendix A

APPENDIX A

EMERGENCY HEALTH AND SAFETY INFORMATION

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APPENDIX A

EMERGENCY HEALTH AND SAFETY INFORMATION

The OpTech Health and Safety Plan will be used for the Site Inspection at the Seattle ANGS. One copy will be given to each subcontractor for the SI. Each subcontractor worker at the Seattle ANGS will be required to review the OpTech Health and Safety Plan.

A.1 EMERGENCY CONTACTS

In the event of any situation or unplanned occurrence requiring assistance, the appropriate contact(s) will be made from the list below. For emergency situations, contact will first be made with the Site Manager (SM), who will notify emergency personnel, and then contact the appropriate response teams. This emergency contacts list must be kept in an easily accessible location at the site.

Seattle Air National Guard Station Contingency Contacts

Contact	Phone Number
SMSgt Dennis Hovland	1-206-764-5614
Fire Department	911
Security Police	911
Station Communications	1-206-764-5600

Note: When using a Station telephone to call on Station, dial only last four digits of the phone number.

Medical Emergency

Contact	Phone Number
Hospital - Harborview Medical Center	1-206-223-3000
Emergency Room	1-206-223-3074
Ambulance Service	911

Route to Hospital: From main gate, turn right on Willow Street, go approximately 0.1 miles, then turn right on Carleton Avenue. Go approximately 0.75 miles, then take I-5 North. Go approximately 4.0 miles, turn right on James Street, and then go approximately 0.2 miles to 9th Avenue. Turn right on 9th Avenue, go 0.1 miles, and hospital is on the right. Travel time from site: 10 minutes (see map on next page).

SOURCE: USGS & NATIONAL OCEAN SERVICE. 7.5' X 15' TOPOGRAPHIC - BATHYMETRIC QUADRANGLE MAP SOUTH SEATTLE, WASHINGTON, 1983.

FIGURE A.1	NEAREST ROUTE TO HOSPITAL 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION
P\SEATTLE\SEAHOSP		24 JUN 1993

KCSlip4 38414

SEA404944

A.2 AIR MONITORING ACTION LEVELS

Concentration of Organic Vapor in Breathing Zone*	Action
1 ppm benzene	Stop work until levels dissipate, or ventilate area.
> 100 ppm toluene, xylenes, or ethyl benzene	Stop work until levels dissipate, or ventilate area.

*Based on threshold limit value/time weighted average (TLV-TWA) exposure limits for toluene, xylenes, and ethyl benzene, assuming benzene does not exceed 1 ppm.

A.3 EMERGENCY RESPONSE PLAN

The contractor policy shall provide for evacuation of personnel from areas involved in hazardous material emergencies and for summoning outside assistance from agencies with personnel trained to deal with the specific emergency. This section outlines the procedures to be followed by contractor personnel in the event of a site emergency. These procedures are to be reviewed during the onsite safety briefings conducted by the Site Safety Officer (SSO).

Paramedics will be summoned in the event of a serious injury; they will arrange to transport the victim to the nearest appropriate facility. A first aid kit will be available at the site for use in case of minor injuries. If anyone receives a splash or particle in the eye, the portable eyewash will be used to irrigate the eye for 15 minutes. If direct contact with contaminants occurs, affected skin areas will be washed immediately with soap and water.

In the event of serious trauma or unknown chemical exposure, the affected employee should be stabilized by an employee(s) while others consult the emergency phone number list and telephone for immediate ambulance support.

Workers with suspected back or neck injuries are <u>NOT</u> to be moved until professional emergency assistance arrives.

At least one person at the site will have current certification in First Aid and Cardiopulminary Resuscitation (CPR).

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Appendix B

APPENDIX B

EQUIPMENT OPERATION, MAINTENANCE AND CALIBRATION

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APPENDIX B

EQUIPMENT OPERATION, MAINTENANCE AND CALIBRATION

B.1 CALIBRATION PROCEDURES

Field Equipment

The analytical and health and safety screening instruments that may be used in the field during the SI are:

- Field GC
- Photoionization detector (PID)
- Specific Conductance Meter
- pH Meter
- Temperature Meter

The instruments will be calibrated according to manufacturer specifications before and after each field use, or as otherwise required. Where necessary, instruments will be calibrated each day during field use.

Field GC

The field GC will be operated and standardized using a 1 ppm BTEX headspace sample for a 1-point calibration. This headspace standard will be made fresh daily by dilution of a 2,000 ppm BTEX stock solution. This calibration will be checked periodically during usage, typically after 5-10 sample analyses. Air blank samples will also be used to assess any problems with sample or standard cross-contamination.

Photoionization Detector

Calibration of the PID will be performed at the start of each day using a standard calibration gas, usually isobutylene. Additional calibrations will be made if the unit experiences abnormal perturbations or readings become erratic. Results of the calibration will be recorded in the field notebook in indelible ink. Calibration procedures will follow manufacturer instructions.

Specific Conductance Meter

Calibration is to be performed at the start of each sampling day using a standard solution of potassium chloride. Adjustment knobs on the meter will be used to set the meter to read the value of the standard. The meter must read within 10 percent of the standard to be considered in control and should read within 5 percent (7 percent is considered a warning level). If the calibration indicates the meter is out of control, a backup unit should be employed; if one is not available, the data will be flagged to note the percent difference between the meter and the standard calibration solution. Readings from conductivity meters lacking calibration adjustments are normally stable; thus, calibration checks are usually limited to checks at the beginning and the end of the sampling day.

pH Meter

Calibration will be performed at the start of each sampling day using National Bureau of Standards traceable buffer solutions which bracket the pH range expected in the samples. Calibration knobs are used to set the meter to read the value of the standard. The meter is then checked during the sampling period, using at least one standard, at a frequency which results in little or no calibration adjustment. If the reading varies more than one-tenth of a unit between calibration checks, the frequency of the checks must be increased.

Temperature Meter

Temperature is measured either using a thermistor built into the specific conductance meter, or by a separate thermometer unit. In all cases, the readings will be checked at least once per field trip using a quality-grade (preferably National Bureau of Standards traceable) thermometer. The frequency of calibration, however, is a minimum; should the unit experience erratic or out-of-tolerance readings, additional checks will be performed. Technicians should be especially mindful of subjecting the unit to harsh conditions (e.g., shock, extreme cold, etc.).

B.2 PREVENTIVE MAINTENANCE

Proper preventive maintenance of field and laboratory equipment is an essential element in an effective IRP PA/SI. The implementation of standard preventive maintenance routines serves to eliminate surprise equipment failures and supports responsive service to the contractor's clients.

Field Equipment

Field equipment will be properly calibrated, charged, and in good working condition before the beginning of each working day. Manufacturer specifications define the required equipment checks for each type of field equipment used. Non-operational field equipment will be removed from service and a replacement will be immediately obtained. Significant repairs to field equipment will not be performed in the field. All field instruments will be properly protected against inclement weather during the field investigation. Each instrument is specially designed to maintain its operating integrity during variable temperature ranges that are representative of ranges that will be encountered during working conditions. At the end of each working day, all field instrumentation will be taken out of the field and placed in a cool, dry room for overnight storage.

All subcontractor equipment (e.g., drill rigs) will arrive at the site in proper working condition each day. All lubricating and hydraulic motor oils will be checked by the subcontractor before the start of each work day to ensure all fluid reservoirs are full and there are no leaks. Before the start of each work day, the Site Manager will also inspect all equipment for fluid leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

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Appendix C

APPENDIX C

PA/SI DATA REQUIREMENTS FOR FEDERAL FACILITY DOCKET SITES

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APPENDIX C

PA/SI DATA REQUIREMENTS FOR FEDERAL FACILITY DOCKET SITES

1. Supply copies of all sampling data, on-site and off-site, including location map, detection limits (see definitions below), raw data sheets, QA/QC documents, date(s) sampled, analytical method(s) used, well or boring logs, and sampling technique(s).

2. Locate and identify on a map all known or suspected sources (see definition below). Supply all information about source(s) such as: dates of operation, use, or spillage; amounts of material deposited, stores, or spilled; dimensions of source(s); known or suspected hazardous substances (see definition below), etc.

3. Provide a description of all aquifers beneath the site, including description of overlying materials, depth first encountered thickness, and composition.

4. For each source, choose one description from Table 1 that describes the groundwater contaminant. Provide complete documentation (i.e., engineering diagrams, photographs (originals) as to why the source meets that description and not any other in the Table.

5. Provide the location of all drinking water wells in all aquifers beneath site in 4 mile radius from the site (property boundary) by HRS distance ring and locate the wells within a one mile radius on a 7.5 minute topographic map. Provide information on depth of well(s), screening interval(s), depth of aquifer(s) encountered, population served for multiple wells (i.e., municipal system), provide the number of wells, location of all wells (regardless of 4 mile limit), average annual pumpage of each well (regardless of 4 mile limit), and total population served by system. Include information on all standby wells.

6. Provide information and location (on 7.5 minute topographic map) of wells within 4 miles that are used to irrigate five or more acres of commercial food or forage crops, or watering of commercial livestock, or ingredient in commercial food preparation, or supply for aquaculture, or supply for a major or designated water recreation area, excluding drinking water use.

7. Provide average number of persons per residence for county (or counties) that site is located in per the U.S. Census Bureau.

8. Identify and locate all surface water bodies with two miles of site making off the drainage routed (shown on 7.5 minute topographic map) from each source to applicable surface water bodies. Provide the average annual cubic feet per second flow for each surface water body within 15 miles downriver or radius from the point of probably entry into surface water. For lakes, provide information on inflow and outflow.

9. For each source, choose one description from Table 2 that describes the surface water containment. Provide complete documentation (i.e., engineering diagrams, photographs [originals]) as to why the source meets that description and not any other in the Table.

10. Provide the number of acres in each drainage basin.

11. From Table 3, choose the predominant soil group (surface soil) which comprises the largest total area within each drainage area.

12. Provide the two year, 24-hour rainfall.

13. From Table 4, choose the floodplain category or each source (supply FEMA floodplain map) and determine if each source meets the criteria from Table 5 (engineer's certification).

14. Provide the location of all drinking water intakes with 15 downstream miles (rivers) or 15 mile radius (lakes, bays, etc.). Provide information on population served. For multiple intakes (i.e., municipal system), provide information on the number of intakes, location of all intakes (regardless of 15 mile limit), and total population served by system. Include information on all standby intakes.

15. Provide information and location of intakes within 15 miles downriver (radius in lake or bay) that are used to irrigate five or more acres of commercial food or forage crops, or watering of commercial livestock, or ingredient in commercial food preparation, or supply for aquaculture, or supply for a major or designated water recreation area, excluding drinking water use.

16. Provide any surface water body 15 miles downriver (radius in lakes or bay) used for drinking water.

17. Provide the average human food chain production (pounds per year) for each surface water body 15 miles downriver of 15 miles radius in lake.

18. Within a 4 mile radius from the site and 15 miles downriver, or radius in lake, identify all sensitive environments that exists. Provide original documentation (USF&W, Natural Heritage Database, State agencies, NOAA, etc.), multiple sensitive environments within a sensitive environment.

19. What is the linear frontage of all wetlands 15 miles downriver or 15 mile radius in lake?

20. Provide the location and number of persons residing, working, attending school, or day care within 200 feet. This includes both the Air and Army Guard.

21. Identify all terrestrial sensitive environments that exist on-site. Provide original documentation (USF&W, natural Heritage Database, State Agencies, NOAA, etc.) and locate each on a 7.5 minute topographic map. Note that there could be multiple sensitive environments within a sensitive environment.

Table 1

All Sources (Except Surface Impoundments, Land Treatment, Containers, and Tanks)

Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures).

No liner.

No evidence of hazardous substance migration from source area, a liner, and:

- (a) None of the following present: (1) maintained engineered cover, (2) functioning and maintained run-on control system and runoff management system, or (3) functioning leachate collection and removal system immediately above liner.
- (b) Any one of the three items in (a) present.
- (c) Any two of the items in (a) present.
- (d) All three items in (a) present plus a functioning groundwater monitoring system.
- (e) All items in (d) present plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area.

No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between liners, functioning groundwater monitoring system, and:

- (f) Only one of the following deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids deposited in source area, or (2) no or nonfunctioning or nonmaintained run-on control system and runoff management system, or (3) no or nonmaintained engineered cover.
- (g) None of the deficiencies in (f) present.

Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquid or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present.

Surface Impoundment

Evidence of hazardous substance migration from surface impoundment.

No liner.

Free liquids present with either no diking, unsound diking, or diking that is not regularly inspected and maintained.

No evidence of hazardous substance migration from surface impoundment, free liquids present, sound diking that is regularly inspected and maintained, adequate freeboard, and:

- (a) Liner.
- (b) Liner with functioning leachate collection and removal system below liner, and functioning groundwater monitoring system.
- (c) Double liner with functioning leachate collection and removal system between liners, and functioning groundwater monitoring system.

No evidence of hazardous substance migration from surface impoundment and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).

Land Treatment

Evidence of hazardous substance migration from land treatment zone.

No functioning, maintained, run-on control and runoff management system.

No evidence of hazardous substance migration from land treatment zone and:

- (a) Functioning and maintained run-on control and runoff management system.
- (b) Functioning and maintained run-on control and runoff management system, and vegetative cover established over entire land treatment area.
- (c) Land treatment area maintained in compliance with 40 CFR 264.280.

Containers

All containers buried.
Evidence of hazardous substance migration from container area (i.e., container area includes containers and any associated containment structures).
No liner (or no essentially impervious base) under container area.
No diking (or no similar structure) surrounding container area.
Diking surrounding container area unsound or not regularly inspected and maintained.
No evidence of hazardous substance migration from container area, container area surrounded by sound diking that is regularly inspected and maintained, <u>and:</u>

- (a) Liner (or essentially impervious base) under container area.
- (b) Essentially impervious base under container area with liquids collection and removal system.
- (c) Containment system includes essentially impervious base, liquids collection system, sufficient contain 10 percent of volume of all containers, and functioning and maintained run-on control; plus functioning groundwater monitoring system, and spilled or leaked hazardous substances and accumulated precipitation removed in timely manner to prevent overflow of collection system, at least weekly inspection of containers, hazardous substances in leaking or deteriorating containers transferred to containers in good condition, and containers sealed except when waste is added or removed.
- (d) Free liquids present containment system has sufficient capacity to hold total volume of all containers and to provide adequate freeboard, single liner under container area with functioning leachate collection and removal system below liner, and functioning groundwater monitoring system.
- (e) Same as (d) except: double liner under container area with functioning leachate collection and removal system between liners.

Containers inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any unsealed or ruptured containers, liquids or materials containing free liquids not deposited in any container, and functioning and maintained runoff control present.
No evidence of hazardous substance migration from container area, containers leaking, and all free liquids eliminated at closure (either by removal of liquid or solidification of remaining wastes and waste residues).

Tank

Belowground tank.
Evidence of hazardous substance migration from tank area (i.e., tank area includes tank, ancillary equipment such as piping, and any associated containment structures).
Tank and ancillary equipment not provided with secondary containment, (e.g., liner under tank area, vault system, double wall).
No diking (or no similar structure) surrounding tank and ancillary equipment
Diking surrounding tank and ancillary equipment unsound or not regularly inspected and maintained.
No evidence of hazardous substance migration from tank area, tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained, <u>and:</u>

- (a) Tank and ancillary equipment provided with secondary containment.
- (b) Tank and ancillary equipment provided with secondary containment with leak detection and collection system.
- (c) Tank and ancillary equipment provided with secondary containment system that detects and collects spilled or leaked hazardous substances and accumulated precipitation and has sufficient capacity to contain 110 percent of volume of largest tank within containment area, spilled or leaked hazardous substances and accumulated precipitation removed in timely manner, at least weekly inspection of tank and secondary containment system, all leaking or unfit-for-use tank systems promptly responded to, and functioning groundwater monitoring system.
- (d) Containment system has sufficient capacity to hold volume of all tanks within tank containment area and to provide adequate freeboard, single liner under that containment area with functioning

leachate collection and removal system below liner, and functioning groundwater monitoring system.

(e) Same as (d) except double liner under tank containment area with functioning leachate collection and removal system between liners.

Tank is aboveground, and inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any material released from tank, liquids or materials containing free liquids not deposited in any tank, and functioning and maintained run-on control present.

Table 2

All Sources (Except Surface Impoundments, Land Treatment, Containers, and Tanks)

Evidence of hazardous substance migration from source area (i.e., source area includes source and any associated containment structures).

No evidence of hazardous substance migration from source areas <u>and:</u>

(a) Neither of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system.

(b) Any one of the two items in (a) present.

(c) Any two of the following present: (1) maintained engineered cover, or (2) functioning and maintained run-on control system and runoff management system, or (3) liner with functioning leachate collection and removal system immediately above liner.

(d) All items in (c) present.

(e) All items in (c) present, plus no bulk or non-containerized liquids nor materials containing free liquids deposited in source area.

No evidence of hazardous substance migration from source area, double liner with functioning leachate collection and removal system above and between liners, <u>and:</u>

(f) Only one of the following deficiencies present in containment: (1) bulk or noncontainerized liquids or materials containing free liquids deposited in source area, or (2) no or nonfunctioning or nonmaintained run-on control system and runoff management system, or (3) no or nonmaintained engineered cover.

(g) None of the deficiencies in (f) present.

Source area inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate is generated, liquids or materials containing free liquids not deposited in source area, and functioning and maintained run-on control present.

Surface Impoundment

Evidence of hazardous substance migration from surface impoundment.

Free liquids present with either no diking, unsound diking, or diking that is not regularly inspected and maintained.

No evidence of hazardous substance migration from surface impoundment, free liquids present, sound diking that is regularly inspected and maintained, adequate freeboard, <u>and:</u>

(a) No liner.

(b) Liner.

(c) Liner with functioning leachate collection and removal system below liner.

(d) Double liner with functioning leachate collection and removal system between liners.

No evidence of hazardous substance migration from surface impoundment and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).

Land Treatment

Evidence of hazardous substance migration from land treatment zone.

No functioning and maintained run-on control and runoff management system.

No evidence of hazardous substance migration from land treatment zone <u>and:</u>

(a) Functioning and maintained and maintained run-on control and runoff management system.

(b) Functioning and maintained run-on control and runoff management system, and vegetative cover established over entire land treatment area.

(c) Land treatment area maintained in compliance with 40 CFR 264.280.

Containers

All containers buried.

Evidence of hazardous substance migration from container area (i.e., container area includes containers and any associated containment structures).

No diking (or no similar structure) surrounding container area.

Diking surrounding container area unsound or not regularly inspected and maintained.

No evidence of hazardous substance migration from container area and container area surrounded by sound diking that is regularly inspected and maintained.

No evidence of hazardous substance migration from container area, container area surrounded by sound diking that is regularly inspected and maintained, <u>and:</u>

(a) Essentially impervious base under container area with liquids collection and removal system.

(b) Containment system includes essentially impervious base, liquids collection system, sufficient capacity to contain 10 percent of volume of all containers, and functioning and maintained run-on control; and spilled or leaked hazardous substances and accumulated precipitation removed in timely manner to prevent overflow of collection system, at least weekly inspection of containers, hazardous substances in leaking or deteriorating containers transferred to containers in good condition, and containers sealed except when waste is added or removed.

(c) Free liquids present containment system has sufficient capacity to hold total volume of all containers and to provide adequate freeboard, and single liner under container area with functioning leachate collection and removal system below liner.

(d) Same as (c) except: double liner under container area with functioning leachate collection and removal system between liners. Containers inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any unsealed or ruptured containers, liquids or materials containing free liquids not deposited in any container, and functioning and maintained run-on control present.

No evidence of hazardous substance migration from container area, containers leaking, and all free liquids eliminated at closure (either by removal of liquids or solidification of remaining wastes and waste residues).

Tank

Belowground tank.

Evidence of hazardous substance migration from tank area (i.e., tank area includes tank, ancillary equipment such as piping, and any associated containment structures).

No diking (or no similar structure) surrounding tank and ancillary equipment.

Diking surrounding tank and ancillary equipment unsound or not regularly inspected and maintained.

No evidence of hazardous substance migration from tank area and tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained.

No evidence of hazardous substance migration from tank area, tank and ancillary equipment surrounded by sound diking that is regularly inspected and maintained, <u>and:</u>

(a) Tank and ancillary equipment provided with secondary containment (e.g., liner under tank area, vault system, double wall) with leak detection and collection system.

(b) Tank and ancillary equipment provided with secondary containment system that detects and collects spiked or leaked hazardous substances and accumulated precipitation and has sufficient capacity to contain 110 percent of volume of largest tank within containment area, spilled or leaked hazardous substances and accumulated precipitation removed in a timely manner, at least

22. For each source, choose one description from Table 8 that describes the accessibility to a human population. Provide complete documentation (i.e., engineering diagrams, photographs [originals]) as to why the source meets that description and not any other in the Table.

23. Provide the total number of people in following distance rings from source(s)?

    - 0-1/4 mile
    - 1/4-1/2 mile
    - 1/2-1 mile
    - 1-2 miles
    - 2-3 miles
    - 3-4 miles

    Use 1990 Census data and/or actual house counts. Document how calculated.

24. For each source, choose one description from Table 9 that describes the gaseous containment. Provide complete documentation (i.e., engineering diagrams, photographs [originals]), as to why the source meets that description and not any other in the Table. From Table 10, choose the appropriate description of each source type. For each source, choose one description from Table 11 that describes that particulate containment. Provide complete documentation (i.e., engineering diagrams, photographs [originals]) as to why the source meets the description and not any other in the Table.

25. Provide the location and area (in acres) of all wetlands within 4 miles of the site.

26. Contact EPA Regional Office immediately if any radionuclides are presents or suspected at site and supply all radiological information known to date.

27. For all of the above information, use primary data source and supply two copies or specify where copies may be obtained.

28. Provide any removals or remedial actions taken place at site.

29. If information relevant to a question already has been provided to the EPA, your answer may precisely cite the previous submittal by title, date, page, and paragraph number rather than resubmitting the information. To assist in your efforts, also enclosed is a copy of EPAs draft Preliminary Assessment Guidance.

DEFINITIONS

Detection Limit (DL)	Lowest amount that can be distinguished from the normal random "noise" of an analytical instrument or method. For this submission, the detection limit used is the method detection limit (MDL), or, for real-time instruments, the detection limit of the instrument as used in the field.
Hazardous Substance	CERCLA hazardous substances, pollutants, and contaminant as defined in CERCLA sections 101(14) and 101(33).
Method Detection Limit (MDL)	Lowest concentration of an analyte that a method can detect reliably in either a sample or blank.
Sample Quantitation Limit (SQL)	Quantity of a substance that can reasonably be quantified given the methods of analysis and sample characteristics that may affect quantification (for example, dilution, concentration).

Site: Area(s) where a hazardous substance has been deposited, stored, disposed, or placed, or has otherwise come to be located. Such areas may include multiple sources and may include areas between sources.

Source: Any area where a hazardous substance has been deposited, stored, disposed, or placed, plus those soils that have become contaminated from migration of a hazardous substance. Sources do not include those volumes of air, groundwater, surface water, or surface water sediments that have become contaminated by migration, except: in the case of either a groundwater plume with no identified source, or contaminated surface water sediments with no identified source, the plume may be considered a source.

weekly inspection of tank and secondary containment system, and all leaking or unfit-for-use tank systems promptly responded to.

(c) Containment system has sufficient capacity to hold total volume of all tanks within the tank containment area and to provide adequate freeboard, and single liner under tank containment area with functioning leachate collection and removal system below liner.

(d) Same as (c) except double liner under tank containment area with functioning leachate collection and removal system between liners.

Tank is aboveground, and inside or under maintained intact structure that provides protection from precipitation so that neither runoff nor leachate would be generated from any material released from tank, liquids or materials containing free liquids not deposited in any tank, and functioning and maintained run-on control present.

Table 3
Surface Soil Description

Coarse-textured soils with high infiltration rates (for example, sands, loamy sands).
Medium-textured soils with moderate infiltration rates (for example, sandy loams, loams).
Moderately fine-textured soils with low infiltration rates (for example, silty loams, silts, sandy clay loams).
Fine-textured soils with very low infiltration rates (for example, clays, sandy clays, silty clay loams, clay loams, silty clays); or impermeable surfaces (for example, pavement).

Table 4
Floodplain Categories

Source floods annually.
Source in 10-year floodplain.
Source in 100-year floodplain.
Source in 500-year floodplain.
None of the above.

Table 5
Flood Containment

Documentation that containment at the source is designed, constructed, operated, and maintained to prevent a washout of hazardous substances by the flood being evaluated (see floodplain category).

Table 6
Sensitive Environments

Critical habitat[a] for Federal designated endangered or threatened species.
Marine Sanctuary.
National Park.
Designated Federal Wilderness Area.
Areas identified under Coastal Zone Management Act[b].
Sensitive areas identified under National Estuary Program[c] or Near Coastal Waters Program[d].
Critical areas identified under the Clean Lakes Program[e].
National Monument[f].
National Seashore Recreational Area.
National Lakeshore Recreational Area.
Habitat known to be used by Federal designated or proposed endangered or threatened species.
National Preserve.

National or State Wildlife Refuge.
Unit of Coastal Barrier Resources System.
Coastal Barrier (undeveloped).
Federal land designated for protection of natural ecosystems.
Administratively Proposed Federal Wilderness Area.
Spawning areas critical[g] for the maintenance of fish/shellfish species within river, lake, or coastal tidal waters.
Migratory pathways and feeding areas critical for maintenance of anadromous fish species within river reaches or areas in lakes or coastal tidal waters in which the fish spend extended periods of time.
Terrestrial areas utilized for breeding by large or dense aggregations of animals[h].
National river reach designated as Recreational.
Habitat known to be used by State designated endangered or threatened species.
Habitat known to be used by species under review as to its Federal endangered or threatened status.
Coastal Barrier (partially developed).
Federal designated Scenic or Wild River.
State land designated for wildlife or game management.
State designated Scenic or Wild River.
State designated Natural Areas.
Particular areas, relatively small in size, important to maintenance of unique biotic communities.
State designated areas for projection or maintenance of aquatic life[i].

[a]Critical habitat as defined in 50 CFR 424.02.
[b]Areas identified in State Coastal Zone Management plans as requiring protection because of ecological value.
[c]National Estuary Program study areas (Subareas within subareas) identified in Comprehensive Conservation and Management Plans as requiring protection because they support critical life stages of key estuarine species (Section 320 of Clean Water Act, as amended).
[d]Near Coastal Waters as defined in Sections 104(b)(3), 304(1), 319, and 320 of Clean Water Act, as amended.
[e]Clean Lakes Program critical areas (subareas within lakes, or in some cases entire small lakes) identified by State Clean Lake Plans as critical habitats (Section 314 of Clean Water Act, as amended).
[f]Use only for air migration pathway.
[g]Limit to areas described as being used for intense or concentrated spawning by a given species.
[h]For the air migration pathway, limit to terrestrial vertebrate species. For the surface water migration pathway, limit to terrestrial vertebrate species aquatic or semiaquatic foraging habits.
[i]Areas designated under Section 305(a) of Clean Water Act, as amended.

Table 7
Terrestrial Sensitive Environments

Terrestrial critical habitat[a] for Federal designated endangered or threatened species.
National Park.
Designated Federal Wilderness Area.
National Monument.
Terrestrial habitat known to be used by Federal designated or proposed threatened or endangered species.
National Preserve (terrestrial).
National or State Terrestrial Wildlife Refuge.
Federal land designated for protection of natural ecosystems.
Administratively proposed Federal Wilderness Area.
Terrestrial areas utilized for breeding by large or dense aggregations of animals[b].
Terrestrial habitat known to be used by State designated endangered or threatened species.
Terrestrial habitat known to be used by species under review as to its Federal designated endangered or threatened status.
State lands designated for wildlife or game management.
State designated Natural Areas.
Particular area, relatively small in size, important to maintenance of unique biotic communities.

[a]Critical habitat as defined in 50 CFR 42.
[b]Limit to vertebrate species.

Table 8
Area of Observed Contamination

Designated recreational area.
Regularly used for public recreation (for example, fishing, hiking, softball).
Accessible and unique recreational area (for example, vacant lots in urban area).
Moderately accessible (may have some access improvements – for example, gravel road), with some public recreation use.
Slightly accessible (for example, extremely rural area with no road improvement), with some public recreation use.
Accessible, with no public recreation use.
Surrounded by maintained fence or combination of maintained fence and natural barriers.
Physically inaccessible to public, with no evidence of public recreation use.

Table 9
Gas Containment Description

All situations except those specifically listed below.
Evidence of biogas release.
Active fire within source.
Gas collection/treatment system functioning, regularly inspected, maintained, and completely covering source.
Source substantially surrounded by engineering windbreak and no other containment specifically described in this table applies.
Source covered with essentially impermeable, regularly inspected, maintained cover.
Uncontaminated soil cover >3 feet:
    Source substantially vegetated with little exposed soil.
    Source lightly vegetated with much exposed soil.
    Source substantially devoid of vegetation.
Uncontaminated soil cover ≥ 1 foot and ≤3 feet:
    Source heavily vegetated with essentially no exposed soil.
    Cover soil resistant to gas migration[a].
    Cover soil type not resistant to gas migration[a] or unknown.
    Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration[a].
    Other.
Uncontaminated soil cover <1 foot:
    Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration[a].
    Other.
Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies.
Source consists solely of intact, sealed containers:
    Totally protected from weather by regularly inspected, maintained cover.
    Other.

[a]Consider moist fine-grained and saturated coarse-grained soils resistant to gas migration; consider all other soils nonresistant.

Table 10
Source Type

Active fire area.
Burn pit.
Containers or tanks (buried/belowground):
    Evidence of biogas release.
    No evidence of biogas release.

Containers or tanks, not elsewhere specified.
Contaminated soil (excluding land treatment).
Landfarm/land treatment.
Landfill:
- Evidence of biogas release.
- No evidence of biogas release.

Pile:
- Tailings pile.
- Scrap metal or junk pile.
- Trash pile.
- Chemical waste pile.
- Other waste piles.

Surface impoundments (buried/backfilled):
- Evidence of biogas release.
- No evidence of biogas release.

Surface impoundment (not buried/backfilled):
- Dry.
- Other.

Other types of sources, not elsewhere specified.

Table 11
Particulate Containment Description

All situations except those specifically listed below.
Source contains only particulate hazardous substances totally covered by liquids.
Source substantially surrounded by engineered windbreak and no other containment specifically described in this table applies.
Source covered with essentially impermeable, regularly inspected, maintained cover.
Uncontaminated soil cover >3 feet:
- Source substantially vegetated with little or no exposed soil.
- Source lightly vegetated with much exposed soil.
- Source substantially devoid of vegetation.

Uncontaminated soil cover ≥1 foot and ≤3 feet:
- Source heavily vegetated with essentially no exposed soil:
  - Cover soil type resistant to gas migration[a].
  - Cover soil type not resistant to gas migration[a].
- Source substantially vegetated with little exposed soil and cover soil type resistant to gas migration[a].
- Other.

Uncontaminated soil cover <1 foot:
- Source heavily vegetated with essentially no exposed soil and cover soil type resistant to gas migration[a].
- Other.

Totally or partially enclosed within structurally intact building and no other containment specifically described in this table applies.
Source consists solely of containers:
- All containers contain only liquids.
- All containers intact, sealed, and totally protected from weather by regularly inspected, maintained cover.
- All containers intact and sealed.
- Other.

---

[a]Consider moist fine-grained and saturated coarse-grained soils resistant to gas migration; consider all other soils nonresistant.

Appendix D

APPENDIX D

PROBE AND BORING LOGS FROM PREVIOUS INVESTIGATIONS

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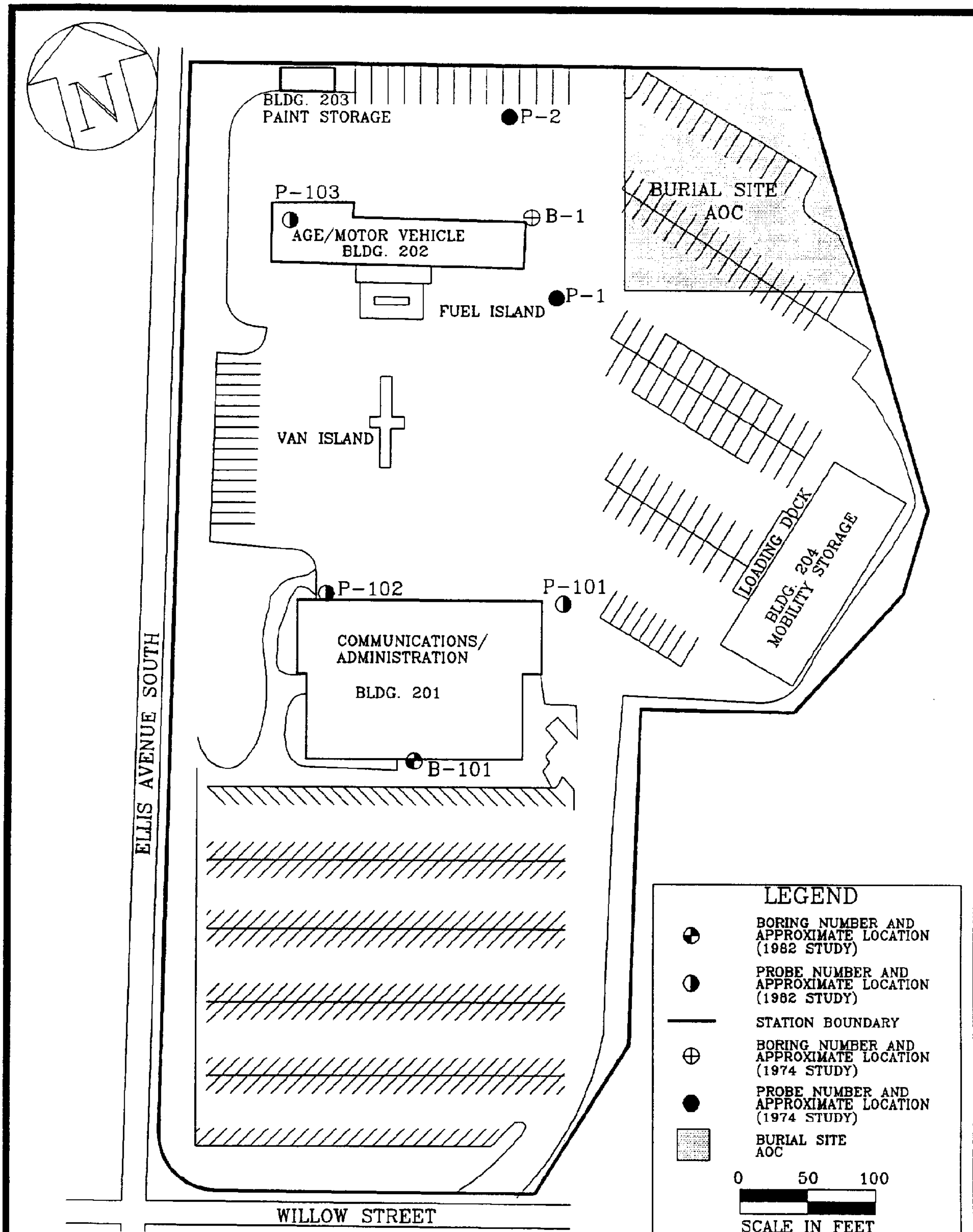


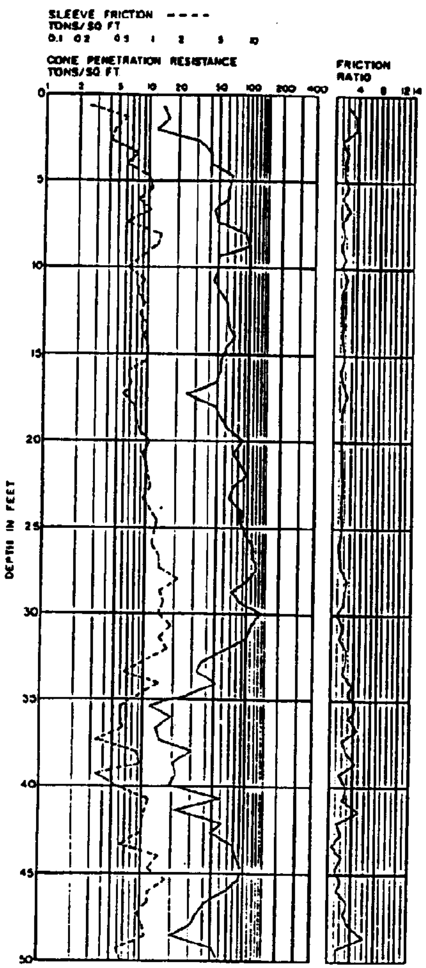
SOURCE: HART-CROWSER & ASSOCS, INC., JANUARY 1982.

APPENDIX D SEA4-6LO	LOCATION OF PREVIOUSLY DRILLED PROBES AND BORINGS 143rd CCSQ, Seattle ANGS Seattle, Washington	OPTECH OPERATIONAL TECHNOLOGIES CORPORATION JANUARY 1994

KCSlip4 38442

SEA404972

LOG OF PROBE P-1



SOIL INTERPRETATION

Loose SAND (pre-drilled)

Loose, sandy SILT. (pre-drilled)

Medium dense to loose SAND.

6 to 10 inch SILT layer.

6 to 10 inch SILT layer.

Medium dense to dense SAND.

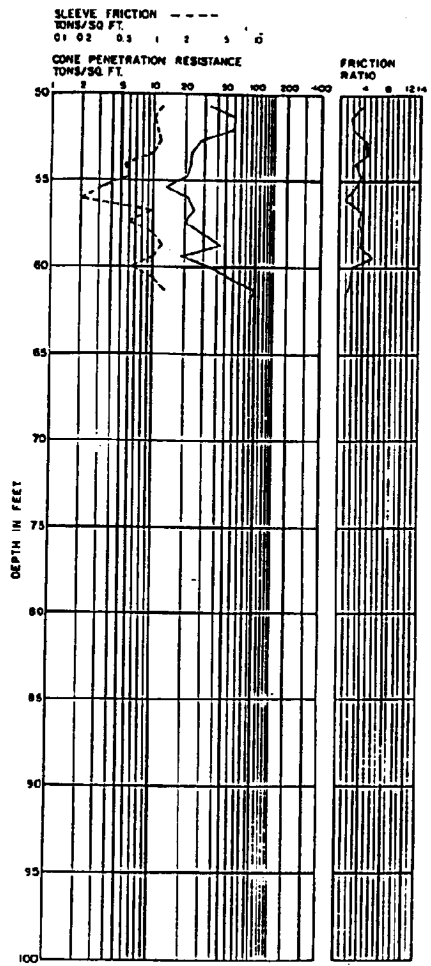
6 to 10 inch silty SAND layer.

Medium dense, sandy SILT with layers of clayey silt and sand.

Medium dense SAND.

Medium dense or medium stiff to stiff, alternating layers of clayey SILT, SILT, sandy SILT, and SAND.

(CONTINUED)



SOIL INTERPRETATION

(CONTINUED)

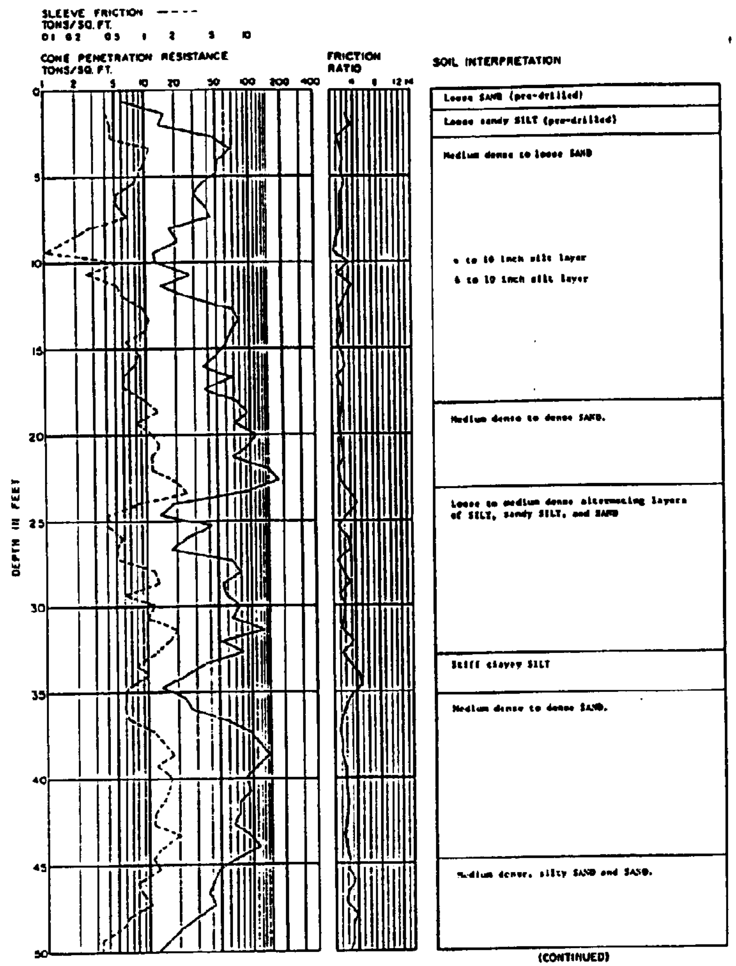
Medium dense or medium stiff to stiff, alternating layers of clayey SILT, SILT, sandy SILT and SAND

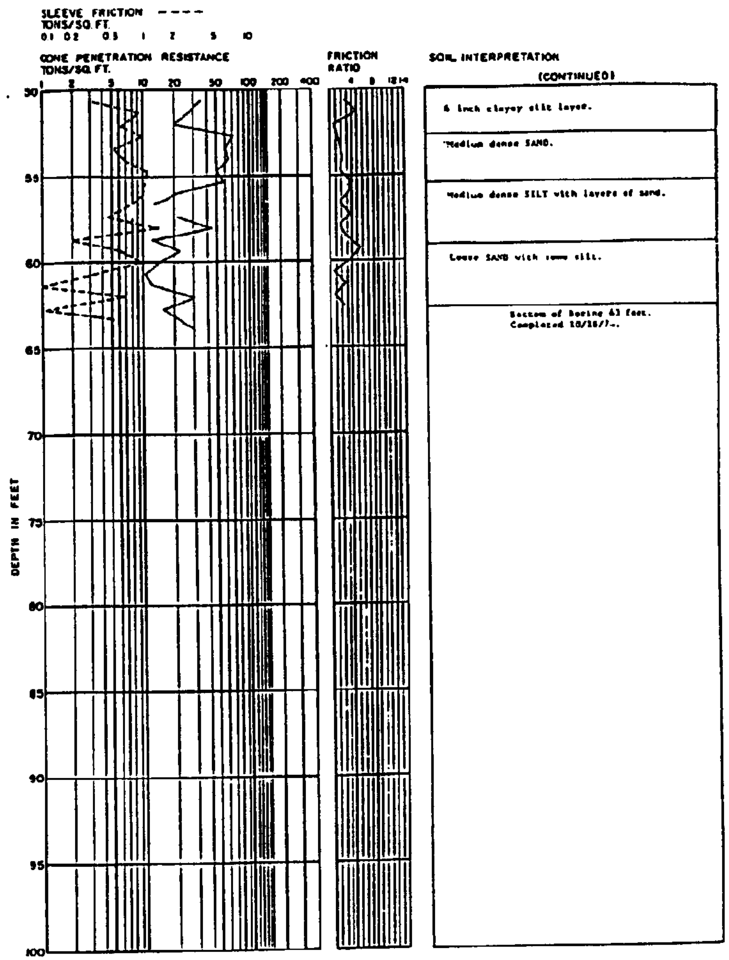
Medium dense SAND.

Bottom of Boring 60 feet.
Completed 10/13/74.

J-141-00 NOVEMBER 1974
HART-CROWSER & associates inc
FIG. A-6

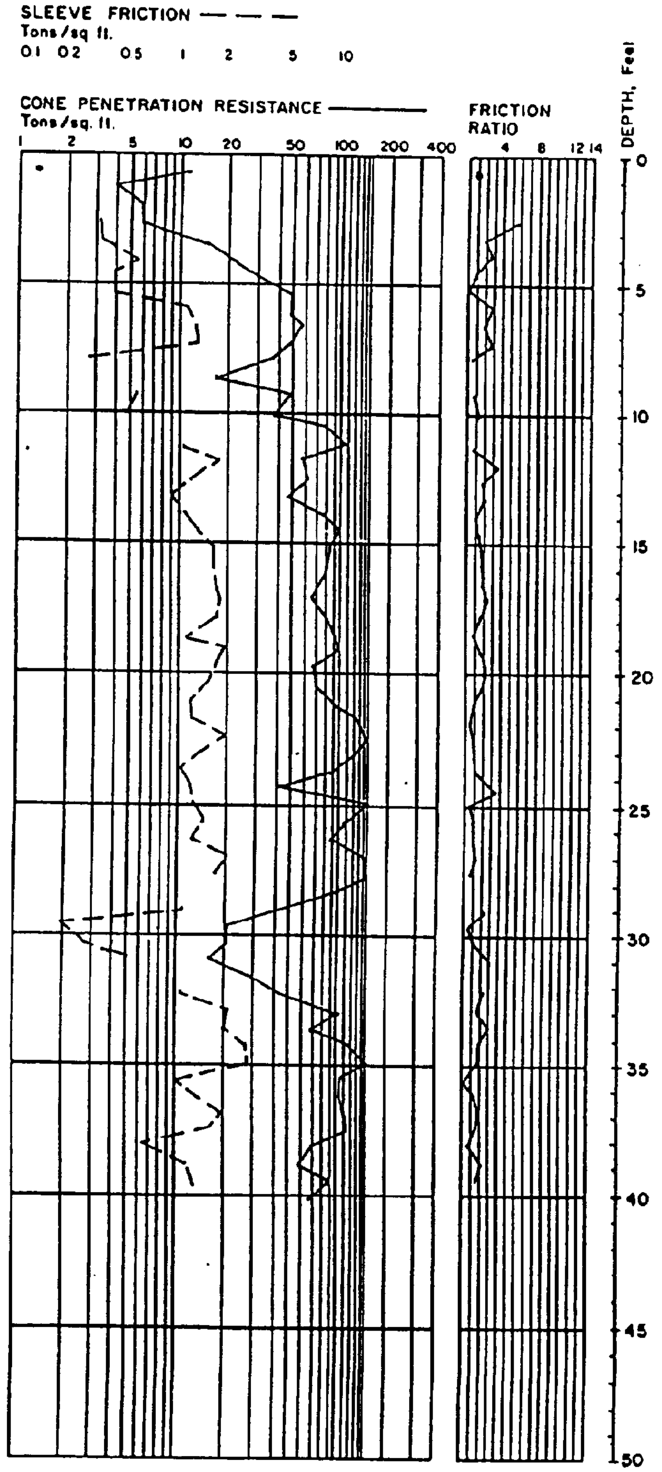
LOG OF PROBE P-2





J-141-00 NOVEMBER 1974
HART-CROWSER & associates inc.
FIG. A-7

Probe Log P-101



SOIL INTERPRETATION

FINE SANDY SILT
(MEDIUM STIFF)

SAND AND SILTY SAND
(LOOSE)

– SILTY LAYER APPROXIMATELY
1/2 FEET

SAND (MEDIUM DENSE)

– (DENSE)

– SILTY LAYER APPROXIMATELY
1/2 FEET

SANDY SILT AND/OR CLAYEY
SILT (MEDIUM STIFF)

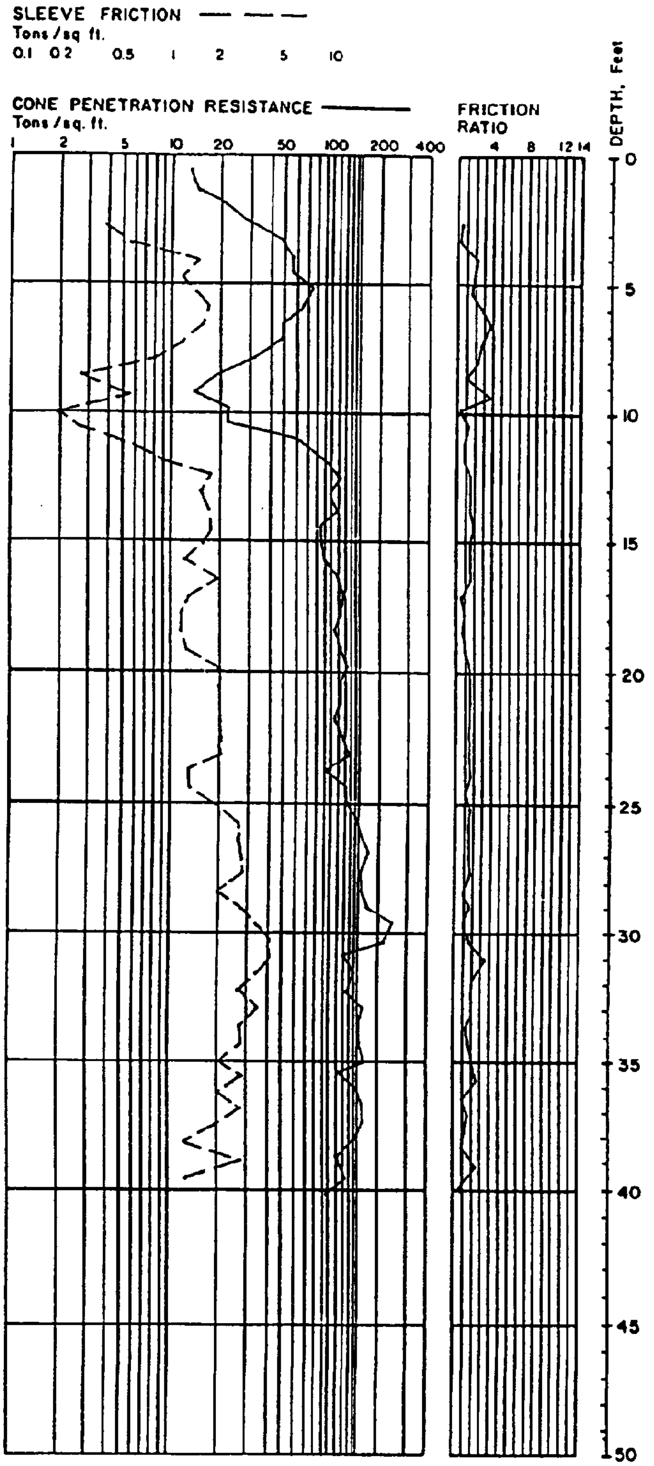
SAND (MEDIUM DENSE TO
DENSE)

– (MEDIUM DENSE)

BOTTOM OF PROBE AT 40 FEET
PROBE COMPLETED 12/18/81

J-141-01 January 1982
HART-CROWSER & associates inc.
Figure A-3

Probe Log P-102



SOIL INTERPRETATION

SILTY SAND? (LOOSE)

SAND AND SILTY SAND (LOOSE TO MEDIUM DENSE)

SANDY SILT (MEDIUM STIFF)

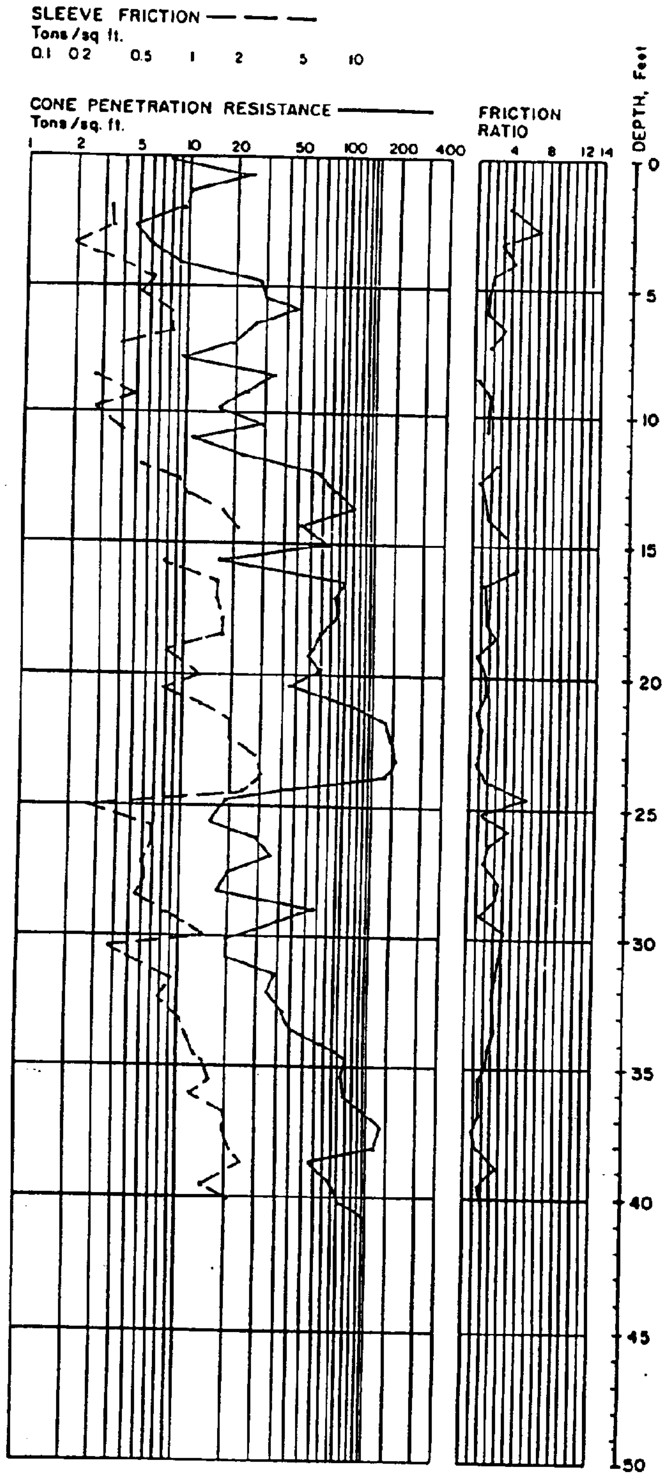
SAND (MEDIUM DENSE TO DENSE)

(DENSE)

BOTTOM OF PROBE AT 40 FEET
PROBE COMPLETED 12/18/81

J-141-01 January 1982
HART-CROWSER & associates inc.
Figure A-4

Probe Log P-103



SOIL INTERPRETATION

CLAYEY SILT (MEDIUM STIFF)

SAND AND SILTY SAND (LOOSE)

SILTY LAYER APPROXIMATELY 1/2 FOOT

SILTY LAYER APPROXIMATELY 1/2 FOOT

SAND (MEDIUM DENSE)

SILTY LAYER APPROXIMATELY 1/2 FOOT

(DENSE)

LAYERS OF CLAYEY SILT AND/OR SANDY SILT AND SAND OR SILTY SAND (STIFF) AND (LOOSE)

SAND (LOOSE)

(DENSE)

(MEDIUM DENSE TO DENSE)

BOTTOM OF PROBE AT 40 FEET
PROBE COMPLETED 12/18/81

J-141-01 January 1982
HART-CROWSER & associates inc.
Figure A-5

BORING LOG B-1

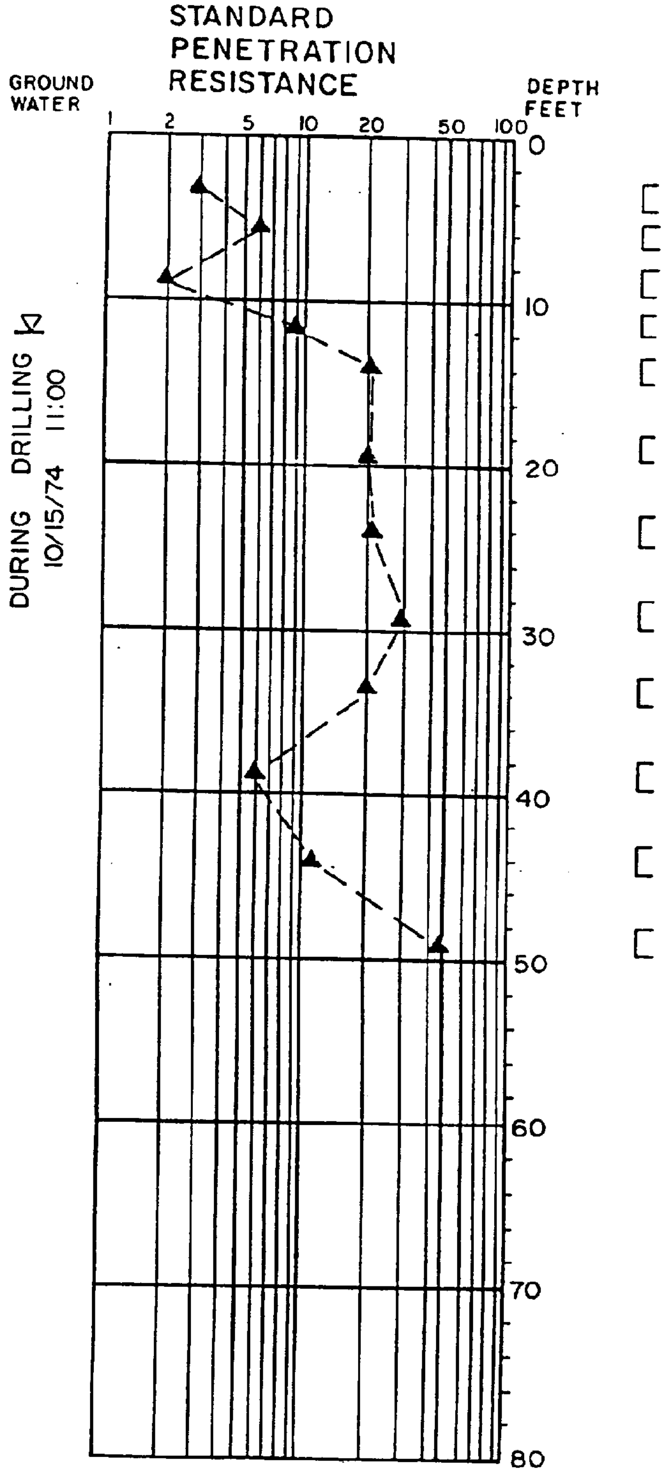
LEGEND

2" O.D SPLIT SPOON SAMPLE

3" O.D SHELBY SAMPLE

▲ BLOWS PER FOOT

● PERCENT WATER CONTENT



GENERALIZED SOIL DESCRIPTION

ASPHALT and GRAVEL subgrade

Loose, brown, fine to medium SAND

Medium dense to dense, gray, fine to medium SAND with scattered organics at 34 ft. ±

Loose, gray, fine to medium SAND grading into slightly silty fine SAND grading into slighly clayey SILT

Medium dense to dense, gray, fine SAND

Bottom of Boring 49.5 feet
Completed 10/15/74

J-141-00 NOVEMBER 1974
HART-CROWSER & associates inc

KCSlip4 38448

SEA404978

Boring Log B-101

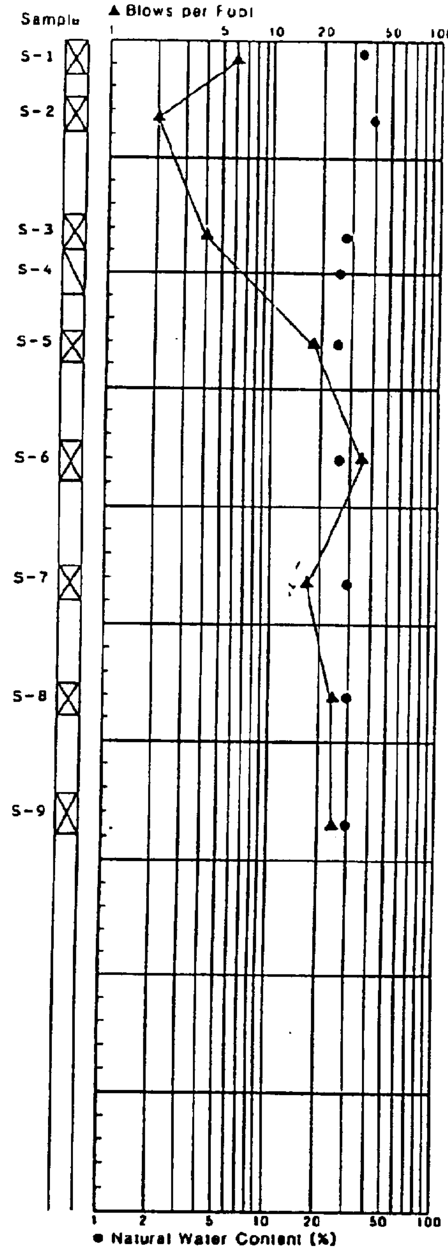
SOIL
INTERPRETATION

STANDARD
PENETRATION RESISTANCE
(140 pound weight, 30 inch drop)

LABORATORY
TESTS

Approximate Ground Surface Elevation in Feet

Soil Interpretation	Depth Feet
SOD 0.20	0
LOOSE, MOIST, MEDIUM BROWN, SLIGHTLY CLAYEY, SILT WITH SOME FINE ROOTS AND ORGANICS.	
VERY LOOSE TO LOOSE, MOIST TO SATURATED, SLIGHTLY CLAYEY, FINE SANDY SILT TO SILTY FINE SAND. (ATD)	5
MEDIUM DENSE, SATURATED, BLACK, FINE SAND.	10–32
BOTTOM OF BORING AT 34.0 FEET. BORING COMPLETED 12/21/81.	35



Groundwater Level

- Bentonite Seal
- Water Level (Date) 2/14/81
- ATD At Time of Drilling
- Observation Well Tip or Slotted Section

Sampling

- 2" O.D. Split Spoon Sample
- 3" O.D. Shelby Tube Sample
- Cutting Sample
- No Sample Recovery

Laboratory Tests

GS	Grain Size Analysis	TUU	Triaxial Unconsolidated Undrained
CN	Consolidation Test	TCU	Triaxial Consolidated Undrained
K	Permeability Test	TCD	Triaxial Consolidated Drained
DS	Direct Shear		
QU	Unconfined Compression, tsf		
TV	Torvane, tsf		
PP	Pocket Penetrometer, tsf		

Water Content (%)

Plastic Limit — Natural Water Content — Liquid Limit

Notes

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level, if indicated, is for the date specified and may vary with the time of year.

J-141-01 January 1982
HART-CROWSER & associates inc.
Figure A-8

KCSlip4 38449

SEA404979

Appendix E

APPENDIX E

SOIL VAPOR METHODOLOGY

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I. Probe Placement

A) A clean probe (3/4-inch galvanized steel pipe) is removed from the "clean" storage tube.

B) The soil gas probe is placed in the jaws of a hydraulic pusher/puller mechanism.

C) A sampling drive point is inserted into the bottom of the probe.

D) The hydraulic pushing mechanism is used to push the probe into the ground.

E) If the pusher mechanism will not push the probe into the ground to a sufficient depth for sampling, a hydraulic hammer is used to pound the probe into the ground.

II. Sample Extraction

A) An adaptor (Figure A) is attached to the top of the soil gas probe.

B) A vacuum pump is attached to the adaptor via polyethylene tubing.

C) The vacuum pump is turned on and used to evacuate soil gas.

D) Two to five probe volumes are evacuated before a sample is collected. Since the flow rate is dependent on resistance to flow, the evacuation time is adjusted to ensure the proper volume is extracted.

E) A gauge on the vacuum pump, which measures the resistance to flow in inches of mercury, is continually monitored to make sure there is an adequate flow of gas from the soil. The gauge must read at least 2 inches of mercury less than the maximum vacuum of the pump in order to obtain a valid soil gas sample.

III. Sample Collection

A) With vacuum pump running, a hypodermic syringe needle attached to a 10 mL glass syringe is inserted through the silicone rubber, which acts as a seal, and down into the metal tubing of the adaptor (Figure A). Tracer Research Corporation's (Tracer Research's) specially designed adaptor eliminates the possibility of exposing the sample stream to any part of the adaptor and associated tubing.

B) Gas samples only contact metal surfaces and never contact potentially sorbing materials (i.e., tubing, hose, pump diaphragm).

C) The syringe is purged with soil gas. Then, without removing the syringe needle from the adaptor, a 2 to 10 millimeter (mL) soil gas sample is collected.

D) The syringe and needle are removed from the adaptor and the end of the needle is plugged.

E) If necessary, a second 2 to 10 mL sample is collected using the same procedure.

IV. Deactivation of Sampling Apparatus

A) The vacuum pump is turned off and unhooked from the adaptor.

B) The adaptor is removed and stored.

C) Using the hydraulic puller mechanism, the probe is removed from the ground.

D) The probe is stored in the "dirty" probe tube.

E) The probe hole is backfilled and capped, if required.

V. Log Book and U. S. EPA Field Sheet Notations For Sampling (Figures B-F)

A) Time (military notation)

B) Sample number

C) Location (approximate description - i.e., street names)

D) Sampling depth

E) Evacuation time before sampling

F) Inches of mercury on vacuum pump gauge

G) Probe and adaptor numbers

H) Number of sampling points used

I) Observations (i.e., ground conditions, concrete, asphalt, soil appearance, surface water, odors, vegetation, etc.)

J) Backfill procedure and materials, if used

VI. Other Record Keeping

A) Client-provided data sheets are filled out, if required.

B) Sample location is marked on the site map.

VII. Determination of Sample Locations

A) Initial sample locations are determined by client (perhaps after consultation with Tracer Research personnel) prior to start of job.

B) Remaining sample locations may be determined by:

1) Client

a) Entire job sample locations set up on grid system.

b) Client decides location of remaining sample locations based on results of initial study, or

2) Client and Tracer Research Personnel

a) Client and Tracer Research personnel decide location of remaining sample locations based on results of initial sample locations.

I. Varian 3300 or Hewlett Packard 5890 Series II Gas Chromatograph (GC)

A) The GC is equipped with an Electron Capture Detector (ECD), a Flame Ionization Detector (FID), a Photo Ionization Detector (PID), and/or a Thermal Conductivity Detector (TCD).

B) Two chromatographic columns are used by Tracer Research for the analysis of most VOCs.

1) A 6-foot, 1/8-inch diameter packed column with Alltech OV101 is used to separate tri- and tetra-chloro compounds with the ECD and aromatic hydrocarbons with the FID. This column does not separate most di-chloro compounds.

2) A 6-foot, 1/8-inch diameter packed column with Supelco SP1000 is used to separate di-chloro compounds from tri- and tetra-chloro compounds.

II. Two Spectra Physics SP4270 or Two 3396 Hewlett Packard Computing Integrators.

A) The integrators are used to plot the chromatogram for each detector analysis and measure the size of the chromatographic peaks. The integrators compute and record the area of each chromatographic peak. The peak areas are used directly to calculate contaminant concentrations.

III. Chemical Standards from ChemServices, Inc., of Westchester, Pennsylvania.

A) Tracer Research uses analytical standards that are pre-analyzed, of certified purities, and lot numbered for quality control assurance. Each vial is marked with an expiration date. All analytical standards are the highest grade available. Certified purities are typically 99 percent.

B) The Quality Assurance procedures used by ChemService were described by the Laboratory Supervisor, Dr. Lyle Phipher.

1) The primary measurement equipment at ChemServices, the analytical balance, is serviced by the Mettler Balance Company on an annual basis and recalibrated with National Institute of Science and Technology (NIST) traceable weights.

2) All chemicals purchased for use in making the standards are checked for purity by means of gas chromatography using a thermal conductivity detector. Their chemicals are purified as needed.

3) The information on the purification and analysis of the standards is made available upon request for any item they ship when the item is identified by lot number. All standards and chemicals are shipped with their lot numbers printed on them. The standards used by Tracer Research are made up in a two-step dilution of the pure chemical furnished by ChemServices.

IV. Analytical Supplies

A) Sufficient 10-µL, 1-cc, 2-cc and 10-cc glass Hamilton syringes so that none have to be re-used without first being cleaned

B) Disposable lab supplies, where appropriate

C) Glassware to prepare aqueous standards

D) Miscellaneous laboratory supplies

I. Standards

A) A fresh aqueous standard is prepared each day. The standards are made by serial dilution.

1) First, a stock solution containing the standard in methanol is prepared at Tracer Research's Tucson office. The stock solution is prepared by pipetting the pure chemical into 250 mL of methanol in a volumetric flask at room temperature. The absolute mass is determined from the product of volume and density calculated at room temperature. Hamilton microliter syringes, with a manufacturer's stated accuracy of plus or minus 1 percent, are used for pipetting. Information on density is obtained from the CRC Handbook of Physics and Chemistry. Once the stock solution is prepared, typically in a concentration range of 50 to 4000 mg/L, a working standard is prepared in water each day. The solute in the stock solution has a strong affinity to remain in methanol so there is no need to refrigerate the stock solution. Additionally, the solute tends not to biodegrade or volatilize out of the stock solution.

2) The working standards are prepared in 40 mL VOA septum vials by diluting the appropriate quantity of the stock solution into 40 mL of water.

B) The standard water purity is verified each day before using it to prepare the aqueous standard.

C) The aqueous standard is prepared in a clean vial using a dedicated syringe each day.

D) Final dilution of the calibration standards are made in water in a VOA vial having a Teflon coated septum cap instead of a volumetric flask in order to have the standard in a container with no air exposure. The septum cap of the VOA bottle permits mixing of the standard solution and subsequent syringe sampling all day long without opening the bottle or exposing the standard to air. The measurement uncertainty inherent in the use of a VOA bottle instead of a volumetric flask is approximately plus or minus 1 percent.

E) The aqueous standard will contain the compounds of interest in the range of 5 to 400 μg/L depending on the detectability of the individual components. The standard will be analyzed at least three times at the beginning of each day to determine the mean response factor (RF) for each component (Figure G). The standard will be injected again after every fifth sample to check detector response and chromatographic performance of the instrument throughout the day.

F) The RF allows conversion of peak areas into concentrations for the contaminants of interest. The RF used is changed if the standard response varies more than 25 percent. If the standard injections vary by more than 25 percent, the standard injections are repeated. If the mean of the two standard injections represents greater than 25 percent difference then a third standard is injected and a new RF is calculated from the three standard injections. A new calibration is started with the new RF's and calibration data.

$$\text{Percent of difference} = 100\left[\frac{A\text{ area} - B\text{ area}}{A\text{ area}}\right]$$

A = mean peak area of standard injection first calibration

B = peak area of subsequent standard injection

G) The low µg/L aqueous standards that are made fresh daily need not be refrigerated during the day because they do not change significantly in a 24-hour period. On numerous occasions, the unrefrigerated 24-hour old standards have been compared with fresh standards and no measurable difference has been detected.

If the standards were made at high ppm levels in water, the problem of volatilization would probably be more pronounced in the absence of refrigeration.

H) Primary standards are kept in the vans and replaced every six months.

I) A client may provide analytical standards for additional calibration and verification.

II. Syringe Blanks

A) Each 10-µL syringe is blanked before use.

B) 1-cc and 2-cc glass syringes are blanked if ambient air concentrations are elevated (greater than or equal to 0.01 µg/L) for components of interest.

C) If ambient air concentrations are greater than or equal to 0.01 µg/L for components of interest, a representative sample of at least two syringes are blanked at the beginning of each day. If representative syringes have no detectable contamination, remaining syringes need not be blanked. If any of representative syringes show contamination, all 1-cc and 2-cc syringes must be blanked prior to use.

D) Syringe blanks are run with nitrogen.

E) If it is necessary for any syringe to be used again before cleaning, it is blanked prior to its second use.

III. System Blanks

A) System blanks are samples of ambient air that are drawn through the probe and complete sampling apparatus (probe adaptor and 10-cc syringe) and analyzed by the same procedure as a soil gas sample. The probe is above the ground.

B) One system blank is run at the beginning of each day and compared to a concurrently sampled air analysis.

C) If a probe must be re-used before cleaning, it is blanked prior to its second use.

IV. Ambient Air Samples

A) Ambient air samples are collected and analyzed a minimum of three times daily to monitor safety of the work environment and to establish site background concentrations, if any, for contaminants of interest.

B) All ambient air samples are documented (Figure G).

V. Samples

A) All samples are analyzed at least twice when analysis run times are less than 8 minutes.

B) Samples are run until reproducibility is within 25 percent, computed as follows:

$$\textit{Percent difference} = \left[\frac{A - B}{(A+B)/2}\right] 100$$

WHERE:

A is the first measurement result

B is second measurement result

If the difference is greater than 25 percent, a subsequent sample will be run until two measurements are made that have a difference of 25 percent or less. Those two measurements are used in the final calculation for that sample.

C) The injection volume is adjusted so the mass of analyte is as near as possible to that which is contained in the standard, at least within a factor of ten.

D) Whenever possible, the attenuation for unknown samples is kept constant through the day (so as to provide a visual check of integrations).

E) A water plug is used as a gas seal in 10-μL syringes.

F) A seal is established between syringes when subsampling.

G) At very high concentrations air dilutions are acceptable once concentration of contaminants in air have been established.

H) All sample analyses are documented (Figure G).

I) Separate data sheets are used if chromatographic conditions change.

J) Everything is labeled in µg/L, mg/L, etc. ppm and ppb notations are to be avoided.

VI. Daily System Preparation

A) Integrator parameters are initialized

1) Peak threshold
2) Attenuation
3) Peak markers
4) Auto zero
5) Baseline offset (min. 10% of full scale)

B) The GC baseline is checked for drift, noise, etc.

C) GC system parameters are set.

1) Gas flows (Note: N_2, air, H_2 tank pressure on Page 1 of chromatograms).
2) Temperatures
    a) Injector
    b) Column
    c) Detector

D) After the last analysis of the day, used septa are rotated out of the injection ports and replaced with fresh septa.

E) Column and injector temperatures are increased to bake out residual contamination.

F) Syringes are cleaned each day

1) 1-, 2-, and 10-cc syringes are cleaned with Alconox or equivalent detergent and brush.
2) 10 µL syringes are cleaned daily with IPA or MeOH and purged with N_2. Syringe Kleen is used to remove metal deposits in the barrel.
3) Syringes are baked out overnight in the oven of the gas chromatograph at a minimum temperature of 60°C.

VII. Sample Splits

If desired, Tracer Research's clients, or any party with the approval of Tracer Research's client, may use sample splits to verify Tracer Research's soil gas or groundwater sampling results.

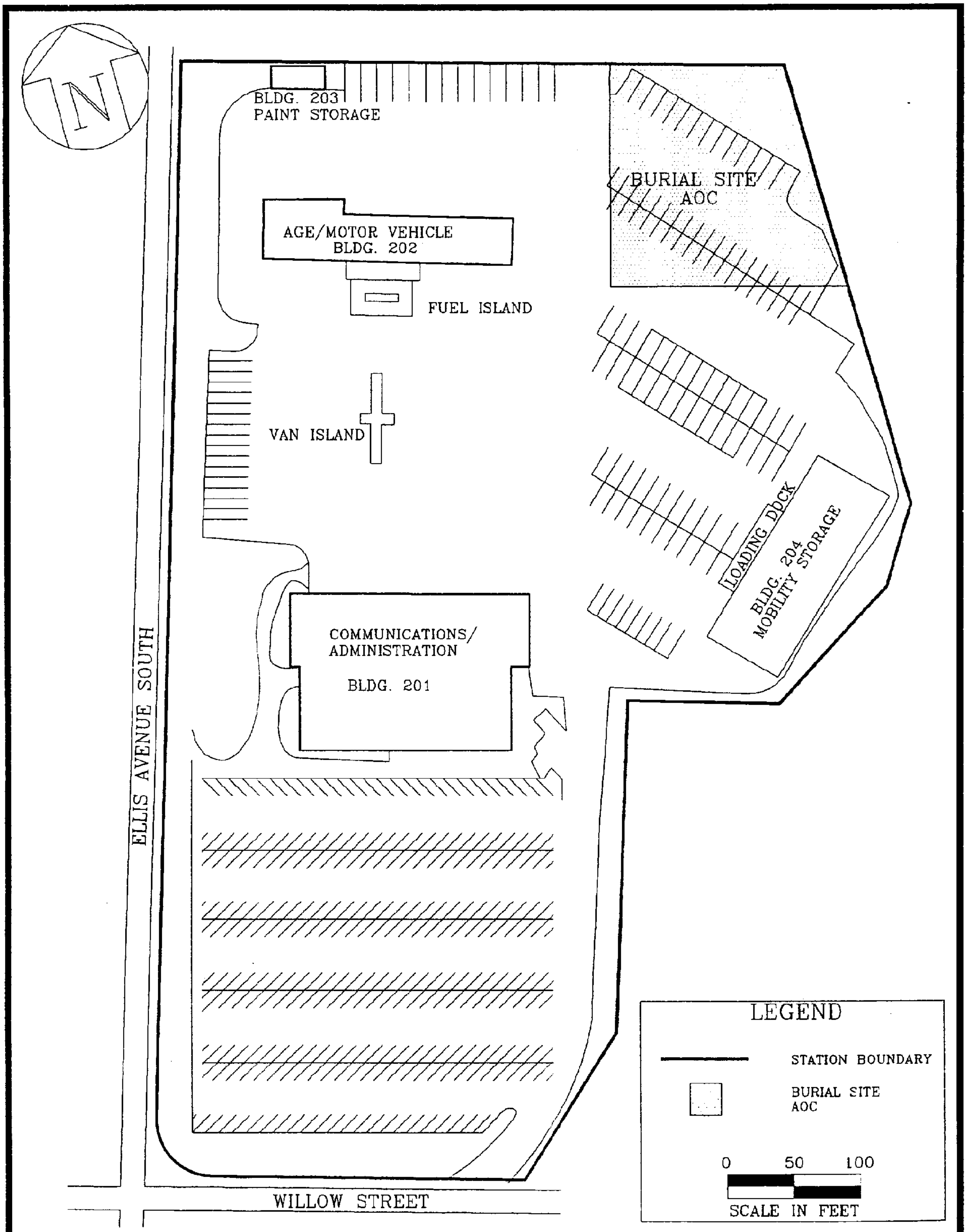
A) Sample splits may be collected in two-valve, flow-through-type, all-glass or internally electroplated stainless steel containers for analysis within 10 days of collection.

   1) Flow-through sample collection bottles are cleaned by purging with nitrogen at 100°C for at least 30 minutes. Once clean, the bottles are filled with nitrogen at ambient pressure and stored.

   2) Sample bottles are filled by placing them in the sample stream between the probe and the vacuum pump. Five sample bottle volumes are drawn through the container before the final sample is collected. The sample should be at ambient pressure.

B) Sample splits can be provided in 10-cc glass syringes for immediate analysis in the field by the party requesting the sample splits.

C) Splits of the aqueous standards or the methanol standards used by Tracer Research for instrument calibration may be analyzed by the party requesting sample splits.



INSIDE
BACK
COVER

F:\SEATTLE\SEA-IBC

SEATTLE ANGS MAP

143rd CCSQ, Seattle ANGS

Seattle, Washington

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